ARCHIVES OF OTOLOGY.

ETIOLOGY AND RESULTS OF EXAMINATION OF FORTY CASES OF CONGENITAL DEAFNESS.

By S. MOOS, Heidelberg.

Translated by F. W. Parham, of New Orleans.

(*With a wood-cut.*)

IN the present work I intend to give a general summary of the etiology and results of examination of forty cases of congenital deaf-mutism, which have occurred in my private practice up to the beginning of the year 1882. This number is very moderate, speaking both absolutely and relatively. I might, perhaps, have stated it considerably higher, had I not proceeded very strictly in the selection of the cases. The fact, however, has hardly escaped any of my colleagues, how difficult, especially in the case of children in the first two years of life, it often is to decide whether we have to deal with a case of congenital or with one of acquired deaf-mutism.[1] Such cases—and there are not a few—I have excluded, even where several occurred in the same family.

As an example, I mention two female cousins from North Germany, regarding whom the relatives in the one case laid the blame on the forcible, but useless, extraction by forceps, resorted to at her birth; and in the other case they stated that the child had, for some time during the first months of life, held the head thrown back (abortive form of cerebro-spinal meningitis?). On the other hand, I have had no

[1] Even mixed cases of congenital and acquired changes in the organ of hearing occur. Compare a report of a dissection of this kind published by me in the *Archives of Ophthalmology and Otology*, vol. ii, No., 1, p. 139, etc.

hesitation (*vide* Nos. 28 and 29 of the table), respecting two cases of double otorrhœa in the first weeks of life, in deciding in favor of congenital deafness, because the twin-sister of the father of the two children was deaf and dumb.

Many a reader will, nevertheless, consider the number of forty cases still too small to discuss, with the help of the results of their examination, a subject which has already been repeatedly and critically discussed on the basis of many thousand cases, and by colleagues far more fitted—I only refer to the Irish statistics by Wilde.[1]

In this respect it may, perhaps, be observed that many statistical collections leave much to be desired. While, for instance, Hartmann's[2] Nassovian statistics of the year 1861 appear very valuable, he declares that the Irish statistics of the year 1861 are not quite reliable, and Mayr[3] demands for that very reason, that the usual statistics, as they are compiled from the data of the census, should be supplemented by separate medico-statistical enquiries.

From a practical stand-point, the dicussion of the subject under consideration, even with the assistance of fewer statistics, is not only justifiable but even somewhat conclusive. Concerning the separate cases which come before us, questions are often to be answered, for which statistical compilations furnish us no material whatever. For instance: whether a child, on account of a malformation of its ears, is and will remain absolutely deaf; or whether the deformity with its consequences is to be remedied; whether an operation can and may be tried, and with what success?[4]

[1] The Census of Ireland for the year 1861, part iii; "Vital Statistics," vol. i, Dublin, 1863.

[2] Taubstummheit und Taubstummenbildung, von Dr. A. Hartmann in Berlin, Stuttgart, F. Enke, 1880.

[3] Die Verbreitung der Blindheit, der Taubstummheit, des Blödsinns und des Irrsinns in Bayern, etc. Bearbeitet von Dr. G. Mayr. Heft 35 der Beiträge zur Statistik des Königreichs Bayern, München, 1877.

[4] This question presented itself to me in my 40th case. I declined the operation, because the elder sister and a female cousin were deaf-mute, and because the other ear was normally formed, and, therefore, might possess sufficient power of hearing.

Number.	Age.	Sex.	Number of the Child.	Results of Physical Examination.	Demonstrable Influences on the Pathological Development of the Organ of Hearing.
1	4	F.	Sixth child; the five older ones hear well.	Negative.	Father intemperate. Rhachitis.
2	2½	F.	The youngest of four children who all hear well.	Papulous exanthema. Swollen cervical glands. Large ulcer at the right angle of the mouth.	Mother between third and fourth gestations infected by the father. Syphilis.
3	4	F.	The third child of four; the fourth died in the sixth month of life; the two older hearing well.	Dull appearance of the mucous membrane of both *Mtt.*	Father and mother first cousins.
4	3	F.	Second child of the marriage; the elder is in every respect healthy.	On the right side: Three spherical auricular appendages, two of which are partly torn off. Imperforate external auditory canal, indicated by a shallow depression. On the left side: A spherical auricular appendage under the lobule. No other anomaly of the auricle, etc. Cannot yet walk.	Asserted twisting of the umbilical cord 13 times around the head at birth.
5	2	M.	First child.	Negative.	Nothing demonstrable.
6	7½	M.	Fifth child; the four others being healthy.	Right ear normal. Left auricle deformed. Consists of three parts, the uppermost representing a round protuberance with normal skin and cartilaginous base, 6 *mm.* high, 1 *cm.* wide. The middle part contains almost no cartilage; is, to a great extent, only a doubling of the skin, 2 *cm* high, ½ *cm.* wide, has a slight indication of the tragus, behind which the impression of the imperforate external auditory meatus is to be felt; the third and lower part represents the normally formed lobule 2 *cm.* high, 7 *mm.* wide. The mastoid process is well formed.	Asserted twisting of the umbilical cord 13 times around the left ear at birth.
7	2½	M.	First child.	Every thing normal.	None.
8	7	M.	Only child.	Every thing normal.	None.
9	3	M.	First child.	The organ of hearing normal, but the occiput quite flat.	None.
10	2½	F.	?	Normal.	None.
11	5	M.	?	Normal.	None.
12	3	M.	Second child.	Normal.	None.
13	3	F.	Sixth child; the five older of normal hearing.	Normal.	The father is the uncle of the mother, and has a deaf-mute brother and sister.
14	1	F.	Seventh child; sister of No. 13.	Normal.	Same as above.
15	10	M.	Second child. A brother, four years older, is under my treatment for a high degree of hardness of hearing.	Normal.	Father and mother first cousins. Father hard of hearing.
16	3	M.	Fourth child.	Negative.	The oldest of the brothers and sisters, 11 years old, is idiotic; the second, 9 years old, is deaf and dumb; the third, 6 years old, hears well. The father of the children is first cousin to his mother-in-law, and suffers from chronic otorrhœa.

Number.	Age.	Sex.	Number of the Child.	Results of Physical Examination.	Demonstrable Influences on the Pathological Development of the organ of Hearing.
17	14	M.	Tenth child of the second marriage; six are still alive.	Negative.	Of the four dead children one was likewise deaf and dumb. From the first marriage descend three, who hear well. The conditions of relationship of the second marriage are as follows: The father of No. 17 is the brother of his present father-in-law; (the mother of No. 17 is the sister of her present mother-in-law.)
18	2	F.	Fifth child. The four older sisters and brothers hear well.	Negative.	A seven months' child.
19	3	F.	?	Scrofulous leucoma of the cornea; swollen, slightly suppurating cervical glands. Very poorly nourished.	Very scrofulous mother. Has otorrhœa of the right side. Cicatrices of formerly suppurating cervical glands.
20	3	F.	?	Negative.	None.
21	3½	F.	Second child. One brother 6, and one 1½ years old, hear well.	Negative.	Parents are first cousins.
22	2½	F.	Eighth and youngest child.	Negative.	Four of the eight brothers and sisters are already dead. Father and mother first cousins. The father and the maternal grandmother have had each a deaf-mute brother. Also some brothers of the grandmother (on the mother's side) were hard of hearing.
23	3	F.	Eighth child.	Negative.	The third child and the seventh likewise deaf and dumb. Parents not related. Nervous diseases or affections of the ear asserted not to be hereditary in the family. Gestation and birth of No. 23 normal.
24	3	M.	?	Negative.	None.
25	4	F.	Second of the three children of one family. The eldest is 6, the youngest 2 years old. Both speak.	Retraction of the handle of the malleus. Hypertrophy of the tonsils. Pharyngeal catarrh.	None.
26	2½	M.	Thirteenth child. Besides No. 26, only two living.	Negative.	One of the 13 children, who died in the 4th year of age, could neither walk nor speak.
27	2½	M.	Fourth child. The eldest three hear well.	Negative.	None.
28	3¾	M.	First child.	Cicatrices on both tympanic membranes. (In the first weeks of life double otorrhœa.)	The father's twin-sister is deaf and dumb.
29	1½	M.	Second child. Brother of No. 28.	On both sides a thickening of the edge of the membrana tympani. Retraction of the reddened handle of the malleus. (In the first weeks of life likewise catarrh of both ears.)	The same.
30	8	F.	Fourth child of five.	Negative.	Parents are first cousins.
31	5	M.	Fifth. Brother of No. 30.	Negative.	The same.

Number.	Age.	Sex.	Number of the Child.	Results of Physical Examination.	Demonstrable Influences on the Pathological Development of the Organ of Hearing.
32	4	M.	First child. The second has normal hearing and can speak.	Entirely flat occipital region. "Besides this anomaly of the skull, there still is a distinct though scarcely perceptible paresis of the right arm and leg, which in former years was more pronounced. It was noticed in the first six months, at a time when the child became sick with a fever and was very fretful. The marked congenital talipes varus on both sides is so far improved by orthopædic treatment that the boy can walk without an apparatus. With an apparatus he can ascend the Kaiserstuhl (mountain near Heidelberg, 1800′ high). "In the circumference of the calves and of the muscles of the thigh there is no difference between the right and the left; the right leg, however, becomes more easily fatigued. "The sensibility seems to be the same on both sides; no difference in the temperature can be ascertained."	All the relatives of the parents have good hearing. (Grandfather on the mother's side in a lunatic asylum.)
33	6	F.	Third child. The elder two of good hearing.	Negative.	None.
34	17	M.	?	The handle of the malleus on both sides appears foreshortened; membrane funnel-shaped and corrugated.	None.
35	4½	F.	?	Eczema of the auricle and auditory meatus.	The grandmother's sister has three deaf-and-dumb children: one a woman of 36 years, a son of 27 years, and another of 24.
36	3	F.	?	Negative.	The grandfather is the brother of the grandmother of No. 35. The parents of Nos. 35 and 36 are not related to each other.
37	4½	M.	?	Negative.	The uncle of the father and the fem. cousin of the mother likewise deaf-mute.
38	10	F.			
39	9	F.	Sister and brother.	See immediately below.	See immediately below.
40	3	M.			

The deaf-and-dumb family, Nos. 38, 39, *and* 40.

From the same family there are descended three deaf-and-dumb children in the second generation. The grandfather was married twice: in the first marriage to a niece; in the second, he was not related to his wife. From the first marriage descended two sons and one daughter; from the second marriage, a son and two daughters. One of these daughters was treated by me for a polypus of the ear.

With this exception, neither the children of the second marriage nor their own children (nine in all) had any disease of the ear. On the other hand, three deaf-mutes were found among the thirteen grandchildren of the first marriage. The daughter of the first marriage had among four children one deaf-and-dumb daughter, who died of typhoid fever in a deaf-and-dumb asylum in her thirteenth year. The eldest son had five children, in every respect healthy. The youngest son had among four children two deaf and dumb, a girl and a boy (the second and the fourth child). The boy had a con-

genital malformation of the right ear (see wood-cut.) It was 1½ *cm.* shorter and had not much more than half the width of its fellow-ear. Helix and antihelix, also tragus and antitragus, and in a less degree the lobule, were atrophied; the entrance into the external auditory meatus perceptible, but closed by a pouch-like pseudo-membrane.

RESULTS OF THE EXAMINATION WITH REFERENCE TO ETIOLOGY.

Nationality.

Of the 40 cases, 2 were from Russia, 2 from England, 36 from Southwest Germany; among these were 28 from the grand-duchy of Baden.

The sex

was equally represented; there were 20 males and 20 females.

The age

varied between 1 and 17 years. Although it is very difficult to determine before the end of the second year, whether a child is deaf and dumb or not, yet I have entered one case of 1 year (No. 14) and one of 1½ (No. 29) among the number of congenital deaf-mutes. Neither could speak a word; both came to me in the company of elder deaf-and-dumb brothers and sisters; and, lastly, in both cases indirect heredity could be ascertained; in the one case, parental consanguinity besides. The further course of the two cases confirmed my supposition.

Additional etiological facts.

In 14 cases of congenital deafness no cause whatever, either remote or proximate, could be assigned; in 7 cases hereditary disposition was present; in 10 cases, parental consanguinity; in 3, both hereditary disposition and parental consanguinity; in 1 syphilis was asserted; in 1, intemperance of the father; in 1, premature birth (seventh month); in 1, a high degree of scrofulosis of mother and child; in 2 cases the twisting of the umbilical cord around the head, or rather around the misshapen ears themselves, was alleged as the cause of the deformity and the deaf-mutism.

Heredity and consanguinity of the parents.

Direct heredity existed in no case, whilst in seven cases (Nos. 23, 26, 28, 29, 35, 36, 37), or in 17.5 %, an hereditary predisposition could be proved; in ten cases, or 25 %, (3, 15, 16, 17, 21, 30, 31, 38, 39, 40), relationship of the parents, and in three cases (13, 14, 22), or 7.5 %, both hereditary predisposition and parental consanguinity could be ascertained.

Deaf-mutism of two children occurred in seven families, of three children in one family. In respect to the influence of relationship of the parents, case 17, and cases 38, 39, and 40 are particularly remarkable, because in these cases the fathers of the children were twice married, the one time to a relative, the other time not. From both marriages came children, *but deaf-and-dumb children only from marriages of consanguinity.*

Such facts show in a glaring light the injurious influence of the blood-relationship of the parents on their descendants, especially in the production of congenital deafness. The contrary facts brought to light by statistics deserve all credit, yet they are after all nothing but brilliant exceptions. If, to account for these exceptions, favorable social and climatic conditions are mentioned (Voisin)[1], this does not apply to the family of my last three cases (38, 39, 40), whose circumstances are accurately known to me. Their residence is such that it serves in summer as a much frequented climatic health-resort for sick and well. The dwelling leaves nothing to be desired in point of comfort and healthy situation, and the circumstances of the family are affluent.

The physician ought never to count on such exceptions; if he is consulted in a case of intended union of blood-relations, he must not refrain from warning against the same, by pointing out what consequences it may have to the offspring. This is, I think, the only thing which can be done on the part of physicians. For nobody will entertain the delusion that we shall ever succeed in passing and thoroughly carrying into effect a law which is directed against marriages among blood-relations, just as little, indeed, as we shall ever succeed in proceeding lawfully and successfully against marriages of tuberculous and epileptic persons.

Influence of syphilis and scrofula.

In case 2, the mother was infected, as was asserted by the father of the child, between the third and fourth gesta-

[1] A. Voisin studied the influence of marriages of blood-relations by carefully investigating the separate families of a small community in France—Batz, (Département de la Loire Inférieure), which dwells on a peninsula somewhat secluded, and for that reason the inhabitants frequently enter into marriages with relatives, but otherwise live under favorable hygienic conditions. Among 3,300 inhabitants are forty-six marriages of blood-relations. Two marriages are childless; forty-four had 174 children. Of five women, each had one miscarriage. Among none of the 174 children did a malformation, mental disorder, idiocy, cretinism, retinitis pigmentosa occur, nor in the rest of the community. Voisin thinks that here the favorable climatic and social conditions protect the species from the degeneration consequent upon marriages of blood-relations, and that the blood-relationship of parents seems harmless to the offspring, if the parents are free from hereditary disease, of good constitution, and living under proper hygienic conditions.

tions; the child itself showed a papulous eruption, swollen cervical glands, and a large ulcer at the right angle of the mouth. I did not doubt in this case that I had to do with a specific hereditary disease of the labyrinth, as the cause of the congenital deafness; my advice, however, to institute an anti-syphilitic treatment was not followed. The 19th case, also, might fall in the same category. The notes in this case are, of the child: scrofulous; very poor nutrition; swollen, slightly ulcerating cervical glands; leucoma of the cornea; and of the mother, strange to say, almost the same results of examination: has otorrhœa of the right side, eucoma of the right cornea, cicatrices from ulcerated cervical glands.

Whilst they formerly generally considered scrofula as the foundation of such complicated disturbances of the senses, modern ophthalmologists, J. Hutchinson, Knapp, Kipp, Horner, and others, therein agree that almost all chronic parenchymatous inflammatory affections of the cornea complicated with disturbances of hearing are of syphilitic nature.

Influence of rhachitis.

Very probably rhachitis is an important cause of early anatomical alterations in the labyrinth. In a case examined in common with Steinbrügge (these ARCHIVES, vol. xi, p. 1, etc.) I found, besides an arrest of development in the labyrinth and the fenestræ, changes depending on rhachitic processes, which can alone form the anatomical basis of the disturbance of hearing.[1]

Brachycephaly.

In Nos. 9 and 32 of the table quite flat occiputs are noted among the results of examination of two boys, the one

[1] There was, moreover, noted: father intemperate. "In the district of Cologne intemperance of the father was noticed six times; in Magdeburg, twice. Investigations made by Falk, who was twice assured by mothers, that conception had taken place in an inebriate state of the father, would hardly lead to a positive result, since here also the question must remain unanswered, how many children with unimpaired senses are begotten by inebriate fathers." Quotation from Hartmann: "Deaf-mutism and Instruction of Deaf-mutes," page 71. Yet to me the demonstration of this fact seems to be of importance. Friedreich has certainly described a number of cases of gray degeneration of the posterior columns, in which conception during intoxication was positively proved to be an etiological factor.

three and the other four years of age. Concerning No. 9, I have never learned any thing further. But no other kind of bodily disturbance could be ascertained as in case 32, and yet there must evidently have existed a considerable atrophy of the posterior lobes of the cerebrum (some of the internal convolutions) just like those two [1] remarkable cases of acquired deaf-mutism which Luys has found and described.[2]

In the second case of Luys the question was about a woman who died of pneumonia after having been, in consequence of variola, entirely deaf from her twenty-fifth year. The left occipital lobe, wasted to a marked degree, showed an irregular atrophy of the surface. The sulcus centralis (scissure perpendiculaire) was changed into a deep furrow, so that the index finger could be laid in it. The furrow, which separated the pli courbe (lobulus tuberis) from the posterior central convolution, was also enlarged. The third cerebral convolution atrophic. The right occipital lobe in a similar manner diminished in size through absorption of the cortical substance; the sulci enlarged. The trunks of the auditory nerves wasted away to a few fibres.

According to the classical researches of Virchow, I consider it probable, that such brachy,—nay, one may say, micro-cephalic skulls, besides defective development of various parts of the brain, occasion also an atrophy of the petrous bone, in which, perhaps, is furnished the anatomical key for the cause of the congenital deafness in such cases. In the paper of Virchow [3] referred to is found the following description of a skull, No. 1232 of the Wurzburg collection:

"A distorted microcephalic skull of an idiotic woman, an inmate of the Julius Hospital. The coronal and sagittal

[1] Besides, a yellowish discoloration and œdematous swelling; the white fibres of the brain leading to the optic thalamus resembling connective tissue.

[2] *Annales des mal. de l' oreille*, 1876; and *Gazette méd.*, No. 29, 1880. Compare Hartmann, *l. c.*, page 208; and Report on the Progress of Otology: Normal and Pathological Anatomy, July to October, 1880, by Steinbrügge, these ARCHIVES, vol. x, p. 80.

[3] Contribution to the History of Development of Cretinism and of the Deformities of Skulls. Page 994 of the "Gesammelte Abhandlungen" (collected papers), Frankfurt, 1856.

sutures are entirely ossified; on the right the spheno-frontal, spheno-parietal, and spheno-temporal sutures totally so, the squamous suture down to the posterior portion; on the left the spheno-frontal and spheno-parietal sutures are completely obliterated. The skull is very short, in front flat and rounded, behind exceedingly defective, so that there is seen from the middle of the sagittal region to the occipital protuberance an almost entirely even surface; only in the vertex is there some compensation. The root of the nose is flat, the nasal bones are long and narrow, the maxillæ prominent, the orbital cavities high and narrow. After removal of the very thickened and heavy calvarium, the base appears very deep and atrophied, crushed in in front as well as on the sides, the petrous bones very small, and especially narrow, and the right one at its apophysis narrowed down almost like a warped leaf," etc., etc.

I do not at all fail to appreciate the great difference between this condition in the dead body, and my experience as regards the living; such a considerable deviation from the normal state was not present in my case; however, there *still exist for both in common the micro-cephalic condition of the skull and the smooth, flat appearance of the occipital region*, indeed, its complete absence, which Virchow has also noticed on the skull of a cretin (*l. c.*, pages 912, 913), a fact which is sufficient, in an investigation of such complicated cases of congenital deaf-mutism, to attract attention to a possible combination of atrophy of the petrous bone with certain anomalies of the skull. This is so much the more necessary as Virchow himself says (*ibidem*): "Unfortunately, there is as yet nothing that can be established concerning the beginning of the ossification of the roof of the skull."

Twisting of the umbilical cord around the head, or rather around the ears at birth. Its supposed influence on a congenital malformation of the external ear.

In the fourth case the right external ear was deformed; instead of the normal auricle there were three spherical appendages, two or which were partly torn off. At the same

time, the external auditory canal was imperforate, the outer opening of which was merely indicated by a shallow depression. On the left side, under the lobule, moreover, a spherical auricular appendage was found. There was no other anomaly on this side. The three-year-old girl could not yet walk. The parents charged the deformity to the twisting of the umbilical cord thirteen times around her head at birth.

In the sixth case the right ear was normal and the left auricle was deformed. It consisted of three parts. The uppermost part had the form of a sphere with normal skin and cartilaginous base, was 1 *cm.* wide and 6 *mm.* high. The middle part contained only a trace of cartilage and presented a reduplication of the skin 2 *cm.* high and $\frac{1}{2}$ *cm.* wide, with slight signs of the tragus, behind which a depression, marking the imperfect external auditory meatus, was to be felt. The third and lowest part presented the normally formed lobule, 2 *cm.* high, 7 *mm.* wide. The mastoid process was of normal shape. *The parents, strange to say, in this case also attributed the cause of the deformity of the left ear to the twisting of the umbilical cord thirteen times around the ear at birth.*

The statements of the parents, concurring in every particular—even with reference to the number of twistings in the cases,—struck me only later in looking over my journal, and if the cases had not been brought to me from places far apart, one might almost come to the conclusion that the cause asserted in the one case had been suggested by the other.

It is possible that a traditional superstition is here involved, about which I could, however, never learn any thing.

The peculiar nature of the deformity described in case 6 does not permit us absolutely to disregard the possibility of its arising from the repeated twisting of the umbilical cord around the left ear. Should the decision result affirmatively, this would have, provided we had to do with no congenital deafness, in so far a practical significance, as we might assume a normal condition, and not necessarily, perhaps, a structural anomaly, of the deeper regions of the or-

gan of hearing, and as operative interference for the purpose of forming a canal up to the membrane of the drum would accordingly offer greater chances of success.

It will therefore be worth while to discuss, above all, the question whether with such a twisting of the umbilical cord, the child can even be born alive.

L. Fürst[1] has treated this subject more in detail. He says (*loc. cit.*, p. 318): "Besides these pseudo-products (sometimes delicate and thread-like, sometimes strong and cord-like, sometimes membranous formations), about the nature of which the most varied hypotheses exist, we have also mentioned the umbilical cord as an agent in producing compression of the fœtal parts. That constrictions of the umbilical cord, under certain conditions, are able so to strangulate the extremities that the peripheral portion wastes away or sloughs off, is established by good observers as a fact. Förster, v. Holst, Simonart, Velpeau, Cazeaux, and others, declare themselves in favor of the possibility of sloughing as a result of constriction by the umbilical cord. G. Braun, Martin, and others, answer that by so strong a pressure on the umbilical vessels, and by the disturbance of circulation induced thereby, the death of the fœtus rather than the atrophy of the constricted parts would follow, while it is denied by the other side that in the event of a constriction being produced by the umbilical cord, a complete interruption of circulation must take place in it. Against the objection that, as the knots in the umbilical cords show, the pressure upon the umbilical vessels may be considerable without thereby disturbing the circulation, it has been justly urged that in cases where parts of the umbilical cord compress each other, the pressure is decidedly weaker than where the counter-pressure of a much more resisting extremity upon the umbilical cord takes place. To bring about the destruction of an extremity by disturbing its nutrition necessitates a constantly-acting force, which exerts its influence in one place for a considerable time, while the fœtus still lives and continues its development in its uninjured parts. The umbilical cord, however, is only in a

[1] Das Amnion in seiner Beziehung zu fötalen Missbildungen. *Arch. für Gynäkologie*, Bd. ii, pag. 313, ff.

condition to do this when the counter-pressure on the vessels acts partially, *i. e.*, only on an artery, or is modified by the particular firmness of the Whartonian jelly. In most cases there will, on account of the arrest of the circulation of blood, be no time for atrophy of a constricted extremity to take place. We might therefore, perhaps, justly consider as an exception the case where the umbilical cord gives rise to such malformations, and assume that then the fault lies mostly with accompanying anomalies, which, as cord-like formations starting from the amniotic membrane, are identical with those formerly mentioned, but without direct reference to the umbilical cord. The filamentous adnexa, therefore, are the chief causes of mechanical disturbance of the development of the fœtus.

If, now, moreover, we resort to cases published, it is remarkable that, concerning the ear in general, no deformity, produced either by the umbilical cord or by amniotic threads and bands, has yet been described. In the *Monthly Journal of Gynecology*, of Busch, vol. xxxiii, page 441, Credé gives a tabular review of thirty-three cases (all up to that time known), with and without "threads," but in none of these cases a deformity of the ear existed, while, for instance, case 23 of the table shows atrophy of the eyeballs, and in the 33d case, described by Credé, many defects and deformities of the skull are found, and no anomaly of the ear is stated. In the recently published case of Ritter,[1] the question was concerning an acranius. The cause of the abnormity was the attachment of the child by too short an umbilical cord. All the soft parts and bones in a line from the third cervical vertebra to the forehead, just above the base of the skull, were cut through by the twisting of the umbilical cord; the existing soft parts and bones, and, consequently, the mutilated ears and the remains of the frontal and petrous bones, appeared directed or crowded together toward the centre of the base of the skull.

Taken all in all, the *possibility* of the origin of the *deformity of the ear on account of the twisting of the umbilical cord, appears highly improbable in a child born alive.*

[1] The eye of an acranius histologically examined. *Archiv für Augenheilkunde*, von Knapp and Schweigger, vol. xi, part 2, p. 215.

CASE OF EXTENSIVE DISEASE OF THE TEMPORAL BONE, WITH HERNIA CEREBRI.*

By T. M. PIERCE, M.D.,

SENIOR SURGEON, INSTITUTION FOR DISEASES OF THE EAR, MANCHESTER, ENGLAND.

L. W., aged thirty-four years, married; sallow, anxious countenance; of average height and well developed. Has seven healthy children all living; had one miscarriage twelve years ago. L. W.'s father is sixty-four years of age, alive and healthy. Patient's mother died at fifty-three, and for some time previously had abscesses "on the head, face, behind the ears, on the jaws, between the shoulders, and on the breast bone." Six sisters of L. W., out of nine, are alive and strong. The subject of notice has had otorrhœa of the left ear since childhood, with frequent attacks of earache. She has been in the habit of poking the ears to relieve the itching and discomfort. L. W. came to me at the Manchester Institution for Diseases of the Ear on June 1, 1881. For one and a half years previously pain in the left ear had become more severe and frequent. In May, 1881, a hard swelling in front of the left meatus, extending from the tragus over the glenoid fossa, was noticed by her medical attendant, who sent her to the institution. On examination there was seen a livid, hard, raised spot the size of a florin, situated in front of the left meatus, above the temporo-maxillary articulation, at a point corresponding with the middle root of the zygomatic process. Movement of the jaw was painful and restricted. The pus from the meatus was of a grayish yellow color, streaked with blood, very profuse and offensive. Previous to cleansing the ear the HD was $\frac{c}{12}$ inch. The TF was heard fairly at the meatus; on the

* Read before the section of Otology, at the British Medical Association meeting at Worcester, 1882. A brief and insufficient abstract of this paper appeared in the *Brit. Med. Journal*, Oct. 21, 1882.

vertex, in the left ear only. The calibre of the meatus appeared enlarged. The anterior, superior, and inferior walls of the meatus were covered with a mass of large granulations concealing extensive caries. The membrana tympani contained a small perforation, which was concealed from view until the polypi were removed. There was intermittent rushing tinnitus aurium. The left Eustachean tube was fairly pervious. The patient complained of constant and severe pain over the left cheek, extending over the parietal bone to the vertex. There was no pain over the mastoid, and no vertigo or vomiting. After removing the granulations (or congeries of small polypi) with fine forceps and applying chromic acid through my perforated speculum, the probe disclosed extensive caries of all parts of the meatus up to the membrane, with the exception of the posterior wall. The HD was now $\frac{1}{16}$ inch. Leeches were ordered to the front of the tragus and over the mastoid. A lotion of

Zinci sulpho-carbol. gr. iv
Liq. opii extr., ʒ ss.
Liq. atropiæ, m. xv
Aq. ad ℥ i

was ordered to be instilled warm after syringing every two hours. A mixture of nitro-muriatic acid with cinchona, ter die, and $\frac{1}{4}$ grain morphia pill twice daily.

June 12th.—The pain and discharge were less, but the meatus was again filled with granulations, which bled freely when removed and touched with a saturated solution of argent. nit., a proceeding several times repeated since.

June 1st.—A lotion of

Tinct. iodi, ʒ i
Acid. carbolici, gr. iij
Liq. opii. extr., ʒ i
Aq. ad ℥ i

was ordered to be used alternately with the previous one. A mixture containing Donovan's solution was ordered, and nourishing diet. Arsenic, bichloride of mercury, and pot. iod. up to ʒ ij doses, were prescribed during the succeeding two months without checking the progress of the disease in the slightest degree. The use of Voltolini's galvano-cautery completed the removal of all granulations. The disintegration of the bony and cartilaginous portions of the anterior wall proceeded very rapidly, and the skin over the seat of the original discolored swelling was depressed with a well-marked circular edge.

Aug. 15th.—She had left facial paralysis; the drooping of the eyelid, the drawing up of the right side of the face, and smooth-

ness of the left half of the forehead being well evidenced. The patient complained of great pain on the vertex and occiput. There was no vomiting, and the tongue could be protruded straight, though the jaw was moved less and with more difficulty. There was lachrymation of the left eye. The otorrhœa was very great, and large pieces of carious bone came away in the pus.

The pulse was 82, regular; temperature, 99° F.; the bowels were rather confined, but no nausea or vertigo.

Aug. 22d.—The condition of the patient continued the same, and she went about her housework almost as usual. The cup-like depression over the anterior wall of the meatus was now marked by a bluish brown rim, the bone and cartilage beneath the centre having completely disappeared and obliterated the temporal artery. The posterior wall of the meatus was also attacked, and the cartilaginous entrance to the meatus. The progress of the affection, which now seemed to tend backward toward the mastoid, partook of a semi-malignant character, but there was no enlargement of any glands, and an absence of any new tissue formation.

Sept. 5th.—The HD was $\frac{8}{18}$ inch. The otorrhœa was profuse, and pain at night very severe. The patient experienced increasing difficulty in taking her food and in sleeping, and was much weaker. The meatus was dressed with powdered iodoform and morphia. The patient now wished to go to her father's home, and I did not expect to see her again. The disease having completely included the area of the temporal and posterior auricular arteries, her friends were cautioned as to probable hemorrhage, etc.

Nov. 2d.—The patient returned from Sheffield. During her absence very little treatment had been carried on. The entire area of the disease had fallen in, comprising the whole of the external meatus up to the level of the membrana tympani, exposing the capsular ligament of the temporo-maxillary articulation. The auricle was completely undermined and separated in nearly its entire length behind from the mastoid process. The auricle was only slightly attached to the head above and below. The discharge was profuse, dark, and offensive. The HD was $\frac{18}{18}$ inch; the position of the membrana tympani difficult to make out.

Nov. 28th.—The ptosis of the left eyelid diminishing. Pain in

head very severe, but relieved by morphia and by washing the ear with chloride of zinc (gr. ij, ad. ℥ i aq.) and opium lotion, the auricle becoming somewhat livid. No vertigo, vomiting, or hemorrhage occurred up to this date, and patient could not move the jaw sufficiently to take solid food. Particles of carious bone now came through the opening behind the auricle.

Dec. 5th.—Condyle of the ramus of the jaw exposed, the glenoid fossa and zygoma having entirely disappeared, the auricle, which was almost detached, was removed and portions from the cut surfaces and from the edge of the cavity nearest to the left eye were examined microscopically.

Jan. 7, 1882.—The area of disease was now almost large enough to admit the closed fist, and on removal of the thick pus the posterior edge of the ramus of the jaw, the nerves and muscles of the superior triangle of the neck were exposed, and the greater part of the mastoid and petro-mastoid, the ossicula, the membrana tympani, and the squamo-zygomatic element of the temporal bone, were wanting. A pulsating spot about one inch in diameter was seen at the lower part of the left parietal bone, through which, in the course of the next two days, a sac of dura mater and brain substance protruded.

Jan. 12th.—The hernia cerebri was now the size of a large hen's egg, of a reddish brown color, soft and pulsatile. The patient began to complain of pain in swallowing, and down the neck. She was extremely weak, the pulse 85, regular and feeble; temperature 100.4°. No diarrhœa or vomiting, and patient quite conscious, though suffering great pain in the head.

Jan. 20th.—Paralysis of right side, with aphasia. Ptosis of right eyelid. No loss of consciousness, but apparent improvement in the facial paralysis of the left side. Hyperæsthesia of the left side of the face, the left arm and leg. Bowels very confined.

Jan. 23d.—No moaning or pain after the attack of right hemiplegia on 20th. Patient now comatose, but no rigors or vomiting. Slight hemorrhage from the hernia cerebri.

Jan. 25th.—Died at 4 P.M. (quietly).

THE AUTOPSY, forty-eight hours after death, was made by Dr. A. Young (Pathologist to the Manchester Royal Infirmary), and was limited to the head and neck.

The destruction of tissue on the left side was found to implicate both soft and hard tissues to such an extent as to present a deep basin-like excavation. The margins were slightly infiltrated, but nowhere was there the slightest evidence of healing. The external ear and surrounding skin, for a distance of two and a half inches from the original position of the meatus, had gone; also, and to a corresponding extent, the underlying fascia. The greater part of the parotid gland, almost the entire masseter, the lower third of the temporal, and the upper and anterior fibres of the sterno-mastoid, had gone. The whole of the ramus of the lower jaw above the level of the dental foramen was also wanting. The left internal pterygoid was in great part destroyed; a few fibres, however, remained, which indicated its position and connections, whilst of the left external pterygoid its origin only remained. The longus colli, the rectus anticus, the fibres of the superior constrictor, and the left side of the atlas, were exposed at the bottom of the excavation. Higher up the squamo-zygomatic portion of the temporal bone was seen to be absent, also the major part of the petro-mastoid. The branches of the fifth nerve were exposed, and also the sheath of the pneumogastric. The mastoid was almost entirely destroyed, as also the outer end and anterior surface of the petrous. By the destruction of the latter the aquæductus Fallopii, the semicircular canals, and the carotid canal, were exposed.

The membrana tympani and ossicles had gone. The dura mater corresponding to the affected region of the cranium was thickened. The temporal bone presented a circular aperture of about 1¼ inches in diameter, through which the tip of the temporo-sphenoidal lobe of the left cerebral hemisphere protruded. The projecting mass was in a state of pultaceous softening, and of a dirty red color. Further examination of the brain after its removal showed this inflammatory softening to extend into the descending horn of the lateral ventricle, but the organ was, in other respects, free from molecular change. The floor of the cavity produced by the disease was formed by dura mater, cerebral substance, and the superior constrictor of the pharynx. Of the

muscles and nerves in the region affected, the former I have alluded to, the nerve-trunks of the latter had resisted destruction, for instance, the superior dental and lingual nerves were found completely isolated as they crossed the cavity toward their destinations. The ends of the large vascular trunks, carotid, internal maxillary, etc., were found occluded by obliterative endo-arteritis. The lateral and cavernous sinuses contained small blood clots, but no signs of phlebitis could be made out. The floor and sides of the cavity showed slight superficial sloughing, and were coated with pus and débris. Nowhere did there seem to be any destruction of large sections *en masse*. Surrounding tissues showed no marked changes; neighboring lymphatic glands could scarcely be regarded as enlarged or indurated.

Microscopical examinations of the portions of tissue removed on December 5th and at the autopsy, were made by Dr. Dreschfeld, Professor of Pathology, and by Dr. A. Young, Lecturer on Surgical Pathology, at the Owen's College, Manchester. Dr. Dreschfeld reports "the existence of granulation tissue in the sections examined by him, but no new formation."

Dr. Young also failed to find any other indications in the soft tissue, auricle, muscle, and skin, but after the autopsy Dr. Young reports: "The microscopic examination of portions of the remains of the temporal bone showed, however, a very different condition, and exhibited numerous epithelial cell-nests in the intercancellar spaces, together with cell-infiltrations. The bony trabeculæ showed evidences of rarefactive changes and, in parts, of rapid disintegration. Subsequent examination of fresh sections of the soft parts in the vicinity—including sections from the detached auricle—showed again that these tissues were absolutely free from epithelial new formation. The neighboring lymphatic glands were also examined with a similar result.

Remarks.—Cases similar to mine are very rare. From the literature on the subject, I extract the following: "Two cases of extensive absorption of the bones of the head, followed in one by hernia cerebri," by Cæsar Hawkins, F. R. S., vol. 39 of *Medico-Chirurgical Transactions*, London, 1856,

page 285. In the first case quoted by Hawkins, the entire parietal, right half of the occipital, the squamous and mastoid portions of the temporal bone, part of the frontal, and the great wing of the sphenoid, the entire membrana tympani, and right zygomatic fossa were affected with caries. New bone was formed in some places. In connection with the second case quoted, Hawkins comments on the rarity of hernia cerebri from disease of the cranial bones, "because," he points out "the chronic inflammation of the dura mater so far strengthens the membrane, before the formation of the aperture in the bone has to bear the loss of osseous covering when the latter takes place.

In the second case there was a clear history of syphilis: an abscess in the hernia cerebri which discharged during life, and a thickening of other parts of the cranial bones.

The Dupuytren's Museum, Paris, No. 311 in the catalogue, contains a case of Breschet's very much like mine. The perforation is in the left temporal bone, oval from before backward, (in a man of twenty-one); is described as a sarcoma of the dura mater. The greater part of the mastoid, the meatus externus, the glenoid fossa, and the zygomatic arch were destroyed. The amount of injury to the inferior maxilla and spheno-palatine region is not clearly stated. The inner ear was unaffected, and the course of the disease was the reverse of that in my case, viz., from within outward. In the ARCHIVES OF OTOLOGY, vol. x, No. 3, a case is recorded by Dr. Kipp, in many respects similar to L. W.'s, but the signs of epithelioma were early and undoubtedly recognizable. Schwartze reports three cases of primary epithelial cancer of the temporal bone; in all, the point of origin was the mucous membrane of the tympanum. Lucæ (*Arch. f. Ohr.*, Bd. xiv, p. 127) and Delstanche fils (*Arch., f. Ohr.*, Bd. xi, p. 21) report a case each.

Similar cases to the above, as far as the extent of destruction, are quoted by Toynbee in "Diseases of the Ear," edition 1860, p. 387 etc., as contributed by Cooper Foster. "Trans. of the Patholog. Society," London, 1850; Wilde, "Treatise on the Ear," p. 206; Wishart, *Edinburgh Med. and Surg. Journal*, vol. xi; Russell, *Association Journal*,

March 31, 1852. Brunner, also in these ARCHIVES, has recorded a case of epithelial cancer, with similar area of destruction.

In the case of S. W., the diagnosis at first was that of extensive caries of the external meatus, with chronic middle-ear suppuration. The fair amount of hearing and perviousness of the perforation, which continued for some time after I first saw her, precluded the middle or inner ears as the original seat of the disease. The rapid and destructive progress of the disease, which no treatment moderated, suggested a type of disease like rodent ulcer. The absence of enlarged glands under the jaw or in the neck was opposed to a carcinomatous affection. The freedom from hemorrhage, rigors, coma, or pyæmia is remarkable, considering the prolonged duration of the complaint, and the large exposed surface bathed in pus.

The origin of the disease, which resulted in such an extensive destruction of tissue, and which began a few months before the patient came to me, appeared to begin in the anterior wall of the meatus, an unusual position, and it soon involved the posterior wall, the only part not hitherto attacked. The main force of the disease was expended at first in destroying the bone and cartilage of the anterior wall of the meatus, the parotid gland, the zygoma and glenoid fossa, crippling the movement of the inferior maxilla on the left side. An arrest in the activity of the disease in that region occurred about the end of September, and the posterior wall and mastoid became the active foci of disintegration. At the same time, the destructive action extended to the ramus of the jaw, and directly inward toward the pharynx, by which the middle and internal ears were rapidly demolished, and fluid from the mouth occasionally came through the opening. The parietal and temporal regions were the seat of the later stages of the destructive process, obliterating the temporal and posterior auricular arteries, and absorbing the bony tissue, so as to produce a hernia of the brain, before the dura mater had had time to take on an inflammatory thickening in support of the meninges, or to lead to the formation of an abscess in the brain substance.

My patient was exhibited to the Manchester Medical Society on Dec. 7, 1881, as suffering from rodent ulcer, and an abstract of the case up to date was given in the *Brit. Med. Journal*, on Jan. 7, 1882. Rodent ulcer is usually limited to the upper two thirds of the face, of several years' duration, painless in middle-aged persons, rarely beginning after forty, is unaccompanied by enlarged glands, and equally allied to lupus and cancer, is usually oval or circular in shape, and has no tendency to cicatrize. My case corresponds in part only to this description of rodent ulcer, and the microscopic examinations made by Prof. Dreschfeld and Dr. Young of all the tissues except the petrous bone, were opposed to rodent ulcer. Must this case be regarded as one of phagedenic caries of soft and hard parts, dependent mainly on a strumous constitution, the dyscrasia adding its distinctive tendencies to those of the ulceration in a patient predisposed by diathesis, and enfeebled by cachexia, using the latter term as meaning a morbid constitutional state rather than a predisposition,—as Laycock puts it, "a diathesis developed into disease"? The presence of epithelioma in the petrous portion only of the temporal bone, and its absence in all the soft parts removed on Dec. 5th and at the autopsy, favor the view of secondary change (from long-continued local irritation) to a malignant character, a change which was taking place in the parts last attacked, and shortly before death.

HEMORRHAGIC PACHYMENINGITIS — PYÆMIA — ACUTE DEGENERATION OF BOTH ACOUSTIC NERVES— THROMBOSIS OF RIGHT INTERNAL AUDITORY ARTERY.

By S. MOOS and H. STEINBRÜGGE, of Heidelberg.

(Translated by A. Schapringer, of New York.)

WE are indebted to Prof. Fürstner for the opportunity of examining this case, and to Prof. Arnold for the record of the autopsy as well as for the specimens.

The following is an abstract of the history of the patient, as given by Prof. Fürstner.

"Jacob Klinger, aged thirty-four years, has been suffering from progressive paralysis for the last three years, during which time he had repeated paralytic strokes, first on the left and later on the right side. He had a severe one eight days before his death. His hearing power could not be accurately tested on account of his imbecility, but, as far as could be ascertained, it was certainly not lowered to any marked extent.

"Besides hemorrhagic pachymeningitis, there were also present hemorrhagic effusions into the pleura and the right knee.

"I cannot give a more detailed account of the history, as the case is to be published elsewhere."

Autopsy (ten hours after death).

Moderate *rigor mortis*. Extensive bed-sore over sacrum. Skin over right trochanter, on dorsal aspect of left foot, and of ball of right great toe partly reddened, partly shrivelled. Bones small. Chest broad and rather elongated. Cartilages of third and fourth

ribs of right side fractured at a distance of 1½ *cm.* from their junction with the ribs; fractured ends uneven, serrated; perichondrium detached; surrounding parts infiltrated with blood and pus. Sixth rib on left side also fractured at junction of bone and cartilage. A peculiar intumescence, consisting mainly of cartilaginous tissue, found at the junction of the second rib with its cartilage.

Right lung adherent to chest-wall at the seat of fracture. There is a space filled with ichorous fluid within this adherent portion of the lung. Pleural lining studded with hemorrhagic spots. Lung tissue surrounding the cavity grayish red. The cavity communicates freely with a bronchial tube.

On the *left* side there is also an adhesion between the two laminæ of the pleura, corresponding to the seat of fracture of the rib, and also a small cavity filled with ichorous fluid in the lung tissue. Another adhesion in axillary line. Posteriorly both pleural laminæ show abundant hemorrhagic infiltrations, and thick, dark-red fibrinous deposits. The *diaphragm* the same. Upper lobe crepitant on pressure, containing a moderate amount of blood and moisture; lower lobe slightly compressed, otherwise normal.

Calvarium thick, compact, heavy, on inner surface some osteophytic excrescences. In the longitudinal sinus fluid blood. Inner surface of dura mater covered with thick, dark-red deposit consisting almost entirely of blood which can be detached in one continuous layer, and is thicker on left side than on right. Similar changes at base of skull, all the fossæ, especially those of left side, being covered with a similar mass. Yellow discoloration of *pia mater*, more noticeable at base than on convexity of brain. Convolutions, especially those of frontal lobe, markedly atrophic.

Spleen considerably enlarged, hyperæmic, soft, in some places deliquescent.

Both *kidneys* somewhat enlarged, hyperæmic, cortical substance wider than normal, turbid.

Gall-bladder very small, filled with concretions composed almost entirely of pigment. Its wall thickened. *Liver* large, hyperæmic, acini distinct, with yellowish periphery.

Contents of stomach colored with bile, crests of folds infiltrated with blood.

In the *intestines* a scant amount of fæces, mucous membrane dotted with red spots.

Lower part of cervical portion of *spinal dura mater* studded on inner surface with hemorrhagic infiltrations and deposits.

Spinal marrow attenuated, softened.

In *left maxillary articulation* a considerable quantity of pus.

Hemorrhagic infiltrations in synovial membrane, and sanguinolent exudation in cavity of *right knee joint.*

EXAMINATION OF EXTERNAL AND MIDDLE EARS.

A.—*Right temporal bone.*

Pneumatic cavities well developed, extending outwardly beyond the malleo-incudal articulation. The rest of middle ear as well as membrana tympani and external auditory canal normal, except the presence of pseudo-ligaments connecting the crura of the stapes and the tendon of the stapedius muscle with each other as well as with the wall of the labyrinth.

B.—*Left temporal bone.*

External auditory canal filled with a brownish-red mass which under the microscope proves to be composed of yellowish-brown epidermis cells. Epidermic lining of canal can be detached in one continuous mass (desquamative inflammation).

Membrana tympani. Handle of malleus not shining through. Membrane bluish. A cylindrical prominence, tapering below, in front of handle. *Microscopic examination*: Vessels of cuticular layer filled with blood corpuscles. Extravasations of blood of different sizes.

Tympanic cavity filled with whitish, yellow, sticky fluid. Bone surrounding antrum hyperæmic. *Microscopic examination*: Epithelium of mucous membrane normal; blood-vessels scarce, normal in structure; lymph-channels numerous, wide, their walls attenuated, containing colorless cells, and here and there a homogeneous, hyaline substance. The recess of the fenestra rotunda permeated by pseudo-ligaments.

Thin hemorrhagic deposit on *dura mater* covering the posterior surfaces of both petrous bones, which is continued into the internal auditory canal of right side, especially along its outer wall. Under the microscope this deposit proves to be composed of delicate, wavy, connective tissue,

enclosing arachnoidal endothelial cells, newly formed blood-vessels, blood corpuscles on the point of being converted into pigment, besides a great deal of completely formed pigment (the result of old hemorrhages).

Microscopic examination of right labyrinth.

Transverse sections show the internal auditory artery to be thrombosed in different places. In the neighborhood of the entrance of the internal acoustic canal the thrombi are incomplete, while those situated in the distal portion fill the vessel completely, and are visible even to the naked eye. They are composed of red and white blood corpuscles and detritus. The branches of the artery having their origin beyond the thrombosed part are empty and surrounded with extravasations. On the inner surface of the sheath of the nerve there are two rust-colored deposits, one 3 *mm.* long, and 1 *mm.* wide; the other, situated nearer to the tractus spiralis, 2 *mm.* long, and 1½ *mm.* wide; both being composed of yellowish-red globules, mulberry-shaped groups of pigment cells, and numerous white blood corpuscles. In the neurilemma there are also deposits of blood and pigment. Further on toward the periphery the sections of the nerve fibres are not round but polygonal. Between the fibres are seen granular cells and numerous hyaline globules having a diameter twice as large as that of a red blood corpuscle, some even larger. In the centre of many of the sections of the nerve round or oval translucent masses can be made out, which are sharply defined by interfascicular connective tissue, and consist of detritus of medullary substance and hyaline globules. In a few instances these masses were irregular in shape, not sharply defined, and surrounded by nerve fibres in every stage of degeneration.

Microscopic examination of left labyrinth.

Bony deposit in posterior wall of vestibule. No thrombus in any artery. Capillaries well filled. In the arachnoidal sheath and between the fibres of the acoustic nerve small extravasations of blood, but no pigment. The nerve

fibres on being teased break easily into fragments, producing the appearance as if the nerve had been cut into transverse sections. Otherwise the majority of the fibres are normal, and only a few show the same degenerative changes as those on the right side. There are a few small extravasations of blood between the fibres of the facial nerve. The latter is otherwise in a better condition than the acoustic nerve.

In the vestibule a yellowish coagulum is visible to the naked eye, which covers the outer wall of the utriculus, and the other walls of the perilymphatic space situated in front of it. Under the microscope it proves to be composed of a finely granular mass (albumen?) enclosing a few cells which are possibly derived from the suspensory ligaments.

The blood-vessels of the labyrinth are well filled, the blood corpuscles in the capillaries showing a polygonal form owing to compression.

In the outer wall of the utriculus and the frontal ampulla as well as in the nerve zone of the latter a small quantity of globular pigment is scattered. The nerves of the labyrinth are well preserved.

Right labyrinth.

Behind the frontal ampulla is a bony deposit 4 *mm.* in height, and 3 *mm.* in width.

No yellowish deposit visible to the naked eye can be found in the perilymphatic space of the vestibule, but on microscopic examination much coagulated lymph is detected on the outer surface of the utriculus and the semicircular canals.

Blood-vessels and pigment the same as on the right side. Nerves normal.

Numerous colorless crystals, such as rhombic or oblong plates or three-sided prisms, are found everywhere throughout the labyrinth, especially on the crista of the lamina spiralis of the first convolution of the cochlea, the prisms appearing occasionally combined, forming stellate groups. These crystals are possibly a product of the process of decalcification. On the crista of the second convolution is a

rather extensive recent extravasation of blood. Every thing else normal.

Remarks.

Taking into consideration the peculiar condition of the lymphatics in the membranous wall of the right labyrinth, the supposition appears to be justified that there is a certain connection between their condition and the presence of the above-described exudation, especially as the blood-vessels are normal in every respect.

The most remarkable feature is the degeneration of the trunk of the acoustic nerve, which could have been caused: 1, by the subdural and intrafascicular extravasations of blood, some of which were quite considerable in size; 2, by the thrombosis of the internal auditory artery. The thrombi having evidently been formed only a few hours before death, showing especially no evidence of pyæmic origin, probably had little or nothing to do with the process of degeneration of the nerve fibres, which was evidently due to the extravasated blood having torn a great number of fibres and so deprived them of nutritive material. From the fact that only the central portion of the nerve was affected whilst the periphery and the terminal fibres were intact, we can draw the conclusion that the whole process occurred in the last days of life.

HISTOLOGICAL AND CLINICAL REPORT OF ONE HUNDRED CASES OF AURAL POLYPI.

By S. MOOS, and H. STEINBRÜGGE, Heidelberg.

Translated by Drs. William C. Ayres, of New York,* and Jas. A. Spalding, of Portland, Me.

(*With 14 drawings on tables i, ii, and iii.*)

WE have quite an extended series of communications on the structure of aural polypi, and as far as the symptoms, course, and treatment are concerned, there is an extensive literature. However, in those articles on the structure of these polypi, upon which the clinical description is based, the corresponding clinical histories are almost always wanting; and we may say that the purpose of this report is to supply this deficiency. The one hundred cases are partly from our private practice and partly from our clinic.[1]

Many of the patients have been under our observation for years, and we can therefore report whether the cure was permanent or only temporary, state the manner in which relapses took place, and determine the question, what influence on healing, etc., the histological structure has; whether there will be a relapse sooner or later; and the reasons for the same in each case.

* Up to case 84; the remainder by Dr. Spalding.

[1] We have operated on many more than one hundred cases; but one hundred cases seem to us to be most convenient for statistical purposes: many cases can not be included, since the tumors are demanded by the patients or their relatives. We have given a great many to one of our students for examination, but he has not been able to complete his work on account of sickness.

Method of examination.

The polypi were placed in Müller's fluid until they were to be examined, then in absolute alcohol for several days, and cut either free in the hand or embedded between two pieces of liver. The sections were colored with carmine, picrocarmine, or hæmatoxylin, and mounted as usual. When occasion required, they were examined in glycerine. The measurements which are recorded below all refer to hardened specimens.

CASE 1.—*Granulation tumor of the labyrinth wall.*

A man aged forty-one years had ear disease for twenty years from typhoid; for one and a half years discharge from right ear. Anterior half of drum-membrane preserved; origin of tumor, labyrinth wall; handle attached to promontory; anvil wanting. Operated May 24, 1869, and observed until Aug. 14th of the same year. Relapse nine years later. No operation. Length of tumor, 1.2 *cm.* Tumor lobulated. Microscopic examination showed it to be granulation tissue, with degenerated blood extravasations and pigment spots; epithelium mostly cylindrical, some of it ciliated. *Diagnosis: granulation tumor of the labyrinth wall.*

CASE 2.—*Fibroma myxomatosum of labyrinth wall.*

A man, aged forty years. Discharge from left ear for many years. Tumor originated from labyrinth wall, and extended to the external opening of the canal. Anterior half of the drum-membrane preserved. Extensive hemorrhage at operation. Length of hardened tumor 1.4 *cm.* Return after three months. Cured after the second operation.

It was found to be a fibroma with myxomatous portions and with decided cavernous structure at its base. Extensive parenchymatous hemorrhage; many spots under all grades of pigment metamorphosis. Rete Malpighi showed many large cells with numerous nuclei, and also confluent cones which sank into the depth of the tumor (compare fig. 3). The so-called large cells of Malpighi still distinctly to be seen in the deepest parts of the horny layer. The surface covered with cylindrical cells in places. *Diagnosis: fibroma myxomatosum of the labyrinth wall.*

CASE 3.—*Angio-fibroma of the labyrinth wall.*

A woman, aged fifty-four years. Running from the left ear for ten years, with great vertigo. A large tumor filled the external canal; operated, Aug. 9, 1872. Inferior half of drum-membrane destroyed; origin: labyrinth wall. Tumor, 1 *cm.* long and 0.5 *cm.* broad. Complete cure, with defect in drum-membrane remaining.

Structure of tumor angio-fibromatous; a large number of the vessels obliterated. Many fresh extravasations, and numerous cells containing blood corpuscles. Epithelium cylindrical. *Diagnosis: angio-fibroma.*

CASE 4.—*Fibroma of the labyrinth wall, with myxomatous portions.*

A girl, twenty-four years old. Discharge from her left ear for many years. Origin of the tumor: the labyrinth wall. Operated, Oct. 4, 1876. Dimensions: 8 *mm.* long, 3 *mm.* thick. After scraping away a caseous spot in the labyrinth wall with a sharp spoon, cicatrization occurred in eight months; almost complete destruction of the drum-membrane. The pedicle of the tumor had a cavernous structure. The upper parts were principally fibromatous, with small myxomatous portions, and with numerous small, thin-walled blood-vessels. Very many small round cells arranged in groups along the blood-vessels. Surface: cylindrical and ciliated epithelium. *Diagnosis: fibroma, with myxomatous portions.*

CASE 5.—*Fibroma of the labyrinth wall.*

A man, twenty-nine years old. Discharge from his right ear for many years. Operated, Aug., 1877. Treated until the end of Sept. The tumor had a long pedicle, and originated in the wall of the labyrinth. Length of tumor 1½ *cm.*, breadth 1 *cm.* Stroma for the most part fibromatous, with a cavernous structure of the base and a part of the centre. Numerous fresh hemorrhages. Cylindrical epithelium. *Diagnosis: fibroma.*

CASE 6.—*Granulation tumor in region of the stapes.*

A man, thirty-two years old. Discharge for many years from the right ear, with deafness. Anterior half of drum-membrane preserved. A spherical, pale-red tumor extended from the stapes

region and passed through the defect in the drum-membrane. Anvil wanting. Operated, June 24, 1876. Cured end of July, 1876. Loss of taste after the operation.[1] Dimensions of tumor 13 *mm.* long, 7 *mm.* broad. *Diagnosis: Granulation tumor with myxomatous portions; cylindrical epithelium.*

CASE 7.—*Fibroma of labyrinth wall.*

A man, twenty-seven years old; discharge from his left ear for many years. A large tumor surrounded by cholesteatomatous masses sprung from the labyrinth wall. Operated, Nov., 1876; return on Jan. 2d, and in April, 1877. Size of tumor (second relapse) 11 by 6 *mm.* The tumor was made up of tough connective tissue, with but few vessels and cells; many cones passed into its body from the rete Malpighi. Horny layer. *Diagnosis: fibroma of the wall of the labyrinth.*

CASE 8—*Granulation tumor of the labyrinth wall with central cholesteatoma formation.* (Compare case 37 and drawing No. 7.)

A boy, thirteen years old; had otitis media purulenta two years ago after variola. A lobulated tumor perforated the posterior superior quadrant. Operated, April, 1878. Tumor, 1 *cm.* long, and 9 *mm.* thick. Return after two years. Permanent cure by a 25 % solution of acetate of lead.

The stroma of the tumor consisted of formative cells, and blood-vessels, which were filled partly by red blood corpuscles, and partly by proliferation of endothelium. In the centre of the sections, the cells of the rete Malpighi were partly horny and partly degenerated. *Diagnosis: granulation tumor, with central cholesteatoma formation.*

CASE 9.—*Angio-fibroma with central cholesteatoma formation, probably springing from the walls of the labyrinth.*

A man, forty-three years old; discharge from right ear for twenty years; eight polypi, some in the external canal, and some in the drum-cavity, with cholesteatoma formations; drum-membrane entirely destroyed. Operated, Oct. 30, 1876. Size of largest tumor, 12 by 6 *mm.* Cavernous structure in pedicle. The walls

[1] Compare Moos: A case of loss of taste after extirpation of a polypus springing from the region of the stapes. These ARCHIVES, vol. ix, p. 35.

of the vessels very much thickened ; stroma fibrous ; many cholesteatoma patches in the centre of the tumor, as in the preceding case ; many epithelial cones from the rete Malpighi passed into the tumor, and coalesced ; a small quantity of cylindrical epithelium ; mostly flat epithelium in several layers, which showed many horny cells ; the latter were separating from the surface of the tumor. *Diagnosis : angio-fibroma, with central cholesteatoma formation.*

CASE 10—*Granulation tumor of the labyrinth wall.*

A man, forty-two years old ; had scarlet fever at five ; since then discharge from left ear. Polyp extended to the mouth of the external canal. Later examination showed the posterior half of the drum-membrane destroyed ; handle attached to promontory ; origin of tumor in stapes region. Operated, Jan. 15, 1877. Tumor smooth, 2 *cm.* long, and 9 *mm.* broad. Cure with cicatricial healing of the defect in drum-membrane, so that on account of the objective condition he was allowed to take out a policy in a life insurance company, which was denied him before.

Stroma rich in cells and blood-vessels, with myxomatous places here and there. The surface of the tumor showed all species of epithelium, cylindrical, ciliated, and flat ; some of the last having a horny character. The same was true of the depressions in the tumor. *Diagnosis : granulation tumor of the labyrinth wall.*

CASE 11.—*Fibroma of the external canal.*

A girl, twelve years old ; never heard badly ; never had a discharge. For about two weeks she noticed that a dry, hard tumor, the size of a pea, was in the left external canal, near the outer opening ; the canal otherwise normal. The drum-membrane and hearing normal. The tumor was cut off with the polypus scissors ; no relapse ; stroma fibrous ; few blood-vessels. Malpighian cell cones sank into the tumor over the whole surface, and near the surface there were isolated so-called pearl bodies ; a somewhat broad horny layer. *Diagnosis : fibroma (wart ?) of the external canal.*

CASE 12.—*Granulation tumor of the labyrinth wall.*

A young man, aged fifteen. Discharge from left ear for many years. Drum-membrane perforated behind and below. Operated, autumn, 1877. Relapse in 1878. The tumor, the size of a bean, nodular, pedunculated, escaped on syringing, accompanied by

profuse hemorrhage. Origin at posterior part of promontory. Stroma very vascular and cellular; most vessels greatly enlarged and engorged near the pedicle, the elements of the walls of some of them proliferating. Cylinder epithelium, partially ciliated. *Diagnosis: granulation tumor.*

CASE 13.—*Granulation tumors of labyrinth wall.*

A young man of fourteen. Scarlet fever with otorrhœa when five years old. There was a cauliflower tumor extending to the opening of the external canal. Bone-conduction for watch and tuning-fork. Operated, March 9 and 12, 1877. Tumors measured: the first, 2 *cm.* long and 1 *cm.* broad; the second, 2½ *cm.* long, shaped like a mushroom, ½ *cm.* at its root, and 2 *cm.* at its head; and the third, 1 *cm.* long and ½ *cm.* broad, the root of this 4 *mm.* thick. They sprang from the wall of the labyrinth. The drum-membrane was totally destroyed. Besides these there were five or six small granulation nodules in the external canal, which was very broad. The patient refused further treatment.

The tumors showed themselves to be of granulation character, very rich in blood-vessels, and with many depressions which were covered by cylindrical and ciliated epithelium. On account of a further development of these papillary formations, there were cystoid spaces, which were lined by the same epithelium. By further epithelial development inside of these spaces, there were other mushroom formations which, being deprived of nutrition, had become necrosed (compare fig. 6 and case 74). *Diagnosis: papillomatous granulation tumors* of the wall of the labyrinth and of the external canal, with *central strangulated parts of the tumor and consecutive necrosis.*

CASE 14.—*Angio-fibroma of the wall of the labyrinth.*

A man, forty-five years old. Double-sided discharge for many years. Left drum-membrane destroyed. A smooth tumor, 2 *cm.* long and 1.3 *cm.* thick, sprang from the wall of the labyrinth. Stroma hard and fibrous. Flat epithelium and horny layer. *Diagnosis: angio-fibroma of the wall of the labyrinth.*

CASE 15.—*Angio-fibroma of the external canal near the drum-membrane.*

A young man, aged twenty. Had scarlet fever at five. Left otitis media sup. and suppuration of the mastoid process with a

cicatrix on same. There were polypi for many years before the operation, which was done July 14, 1874. The tumor with broad basis reached to the external opening of the canal. Its surface was smooth; it measured 1.8 *cm.* long and 8 *mm.* thick. After the operation, the anterior and posterior walls of the canal were found to be hyperostotic. The handle remained, and was drawn inward and upward. The mucous membrane of the promontory was thick and red. Two days after the operation, facial paralysis occurred on the side operated, which was cured in three months by the use of the constant current. The discharge still continues; sometimes copious, sometimes not so much so.

The structure of the tumor was angiomatous. Flat epithelium and sinking in of cylindrical epithelium into the tumor. Horny layer. *Diagnosis: angio-fibroma of the external canal.*

CASE 16.—*Angio-fibroma of the inner end of the external canal with bony portions, without complication of the drum-membrane or the drum cavity. Permanent cure after one operation.*

L. H., a girl thirteen years old, has suffered for several years from an aural discharge without any apparent cause. The discharge was not bloody. Besides slight diminution of hearing there was no other complication. After removing the secretion, on Aug. 11, 1875, there could be seen a large, broad, pale-red tumor at the inner end of the canal. It was upward and behind in the vicinity of the drum-membrane, and felt hard with the probe. It was removed the next day with Wilde's snare, but it was difficult to cut off on account of its hardness. Bleeding not profuse. It was, 1 *cm.* long; the breadth and thickness of the base 6 *mm.*; the patient left after a week, and returned Oct. 27, 1875, with a relapse. The tumor was again removed with the snare. After treatment, 25 % acetate of lead, which resulted in a cure. Drum-membrane normal, and also the hearing.

The microscopic examination showed: the greatest part consisted of large round granular cells with large and sometimes several small nuclei surrounded by a narrow zone of protoplasm. The tumor mass was extraordinarily rich in blood-vessels, very few of which showed a normal condition. Most of them were filled with proliferated endothelium or blood corpuscles, and enlarged with proliferation of the elements of the walls, in particular the peri-

thelium.[1] When examined in cross-section, numerous radial fibres extended from the outer layer of the proliferated perithelium, which anastomosed with similar fibres coming from other vessels (comp. fig. 9). In this manner there was a net-work formed with broad and narrow meshes, in which the cellular elements formed the ground-substance. In quite a number of places these fibres reached the periphery of the tumor, and sometimes the blood-vessels would be found on the surface of the upper epithelium. Sometimes these fibres were formed into a thick, sinew-like band, when the cellular elements disappeared completely. The blood-vessels did not show this everywhere. In some places they were surrounded by a narrow band of connective tissue which contained numerous spindle cells. In some places, 1.22 *mm.* long and 1.09 *mm.* broad, the connective tissue was free from cells. Sometimes such fibre bands surrounded the blood-vessels which were undergoing destruction.

Other places showed a beginning ossification in the shape of pyramids 0.02-0.076 *mm.* broad and 0.5 *mm.* long. The bony corpuscles were mostly spindle-shaped. Carmine colored the bone much deeper than the rest of the tissue.

Besides these, mostly situated in the central parts of the tumor, there were other bony portions to be distinguished near the periphery. They were either triangular or quadrangular in form. The former measured 1.4 *mm.* in length and 0.3-0.4 in breadth; the latter 1.2 *mm.* in their longest diameter, and 0.3 *mm.* in breadth. They all showed that they were composed of ossified substance in different degrees of ossification, and were separated from each other by large cell territories. The bony ground-substance was sometimes homogeneous, sometimes lamellar. The bone corpuscles were numerous and presented all shapes of these cells. Carmine preparations same as above. To the side and toward the middle, the bony parts were surrounded by a periosteal tissue, which was connected with the fibre bands described above. The surface of the tumor, where the vessels and the fibrous net-work came to the top, was without epithelium; in other places it had several layers of rete Malpighi with a narrow horny layer. *Diagnosis*: *angio-fibroma with ossified portions interspersed.*

[1] There were also isolated spherically dilated capillaries filled with proliferated epithelium.

CASE 17.—*Angio-fibroma of the left labyrinth wall. Four relapses.*

A man, eighteen years old, had a discharge in his early youth. A tumor on his left labyrinth wall the size of a pea. Operated, Dec. 13, 1870. Treated until Dec. 30th of the same year. Return of tumor in Feb., 1871. Operated on Feb. 12th, and treated until Feb. 26th. Return, April 21st, 1872. Operated on March 5th. Return, Oct. 1, 1875. Further history not known. The surface of the tumor showed comparatively narrow Malpighian layer, which sent long and short prolongations into the mass of the tumor. It was everywhere covered by a thin horny layer. The cells of the Malpighian layer sometimes coalesced, and being detached, formed small figures, as in fig. 11. *Stroma of the tumor was angio-fibromatous* (as in fig. 9). *Diagnosis: angio-fibroma.*

CASE 18.—*Angio-fibroma hæmocysticum of the external canal.*

J. P., a young man, eighteen years old, had had a discharge from his left ear for fifteen years, often mixed with blood. Examination showed a central perforation of the posterior half of the drum-membrane, covered by a reddish tumor. It was club-shaped, had a smooth surface, and attached to the posterior superior part of the canal by a broad base. Removed on Aug. 6, 1871, with Wilde's snare. Hemorrhage moderate. Length, 1 *cm.*; breadth and thickness, 8 *mm.* One half of the tumor—the inferior—was a solid mass. The upper half enclosed a kind of cylindrical space 4 *mm.* in diameter. On one side the mass which enclosed this space was ¼–1 *mm* thick, and on the other 3–4 *mm.*

The ground-substance of the lower part, in its centre, was composed of mucous tissue; in its middle and peripheric zones, of round granular cells with large eccentric nuclei, sometimes several nuclei. Between these cells were sometimes degenerated lymphoid cells. The solid parts of the tumor were rich in blood-vessels, which frequently extended up to the epithelium of the surface. The minority of them were empty, the majority filled with blood corpuscles and coagulated serum, or with proliferated epithelium.

The contents of the blood-vessels showed many different changes. The cellular contents were often fatty-degenerated,

and sometimes showed a mucoid (or colloid) metamorphosis. Some vessels contained only a molecular detritus of the proliferated and fatty-degenerated endothelium. In some were only normal blood-corpuscles, or white blood corpuscles alone in fatty degeneration ; with these, also, round shining bodies 3–4 times as large, which were generally homogeneous, without nuclei, but sometimes contained one eccentric dark, granular nucleus. In some we could see an actual dehiscence from the exit of the nuclei.

The walls of the blood-vessels were partly normal, partly thickened by proliferation of their cellular elements, showing club-shaped enlargements. In the periphery of the tumor, thick and thin fibres passed off from the walls of the vessels in all directions, which came in contact with those of other vessels, and formed a network of broad and narrow meshes (see case 16). In the broad meshes were the cellular elements already described ; in the narrow ones they were replaced by fine fibres.

The walls of the cysts consisted of small concentric layers of connective tissue, The inner surface of the wall was lined with round and conical cells in several layers. Next to these, several layers of regular polyhedral cells, which had nuclei only in the deepest layers. Most of them were without nuclei, and filled with a finely granulated fatty-looking mass. The greater part of the contents of the cysts had fallen out in preparation. It consisted of singly or many-nucleated cells, fat globules, molecular detritus, numerous red and a few white blood-corpuscles.

In the outer wall of the above part, which enclosed the macroscopic spherical space, there was a round microscopic one, whose diameter was 0.218 *mm.*, and there was also a spindle-shaped space, the size of which was 0.327 *mm.* in length and 0.109 *mm.* in breadth. Its inner lining was very narrow on its medial, and somewhat broader on the lateral wall. It was made up of connective tissue, which passed over at the two poles into the connective-tissue capsule of the macroscopic space, and was continuous with it. A thin tract of connective tissue passed from one pole of the spindle-shaped cyst to the other, dividing it into two halves. The inner surface of the large space was lined with endothelial cells ; that of the microscopic, with spindle cells. The contents of the spindle-shaped cavity were everywhere a homogeneous mucous (colloid ?) mass, enclosing several varieties of cells : small and large spindle-shaped, with broad and narrow cell-

bodies; small and large, round and oval cells with from one to five nuclei. Some of all the varieties of cells showed fatty degeneration (mucoid metamorphosis of the cell-contents).

In the periphery of the large spherical space, not far from the wall, there were spaces formed by the inward development of epithelium.

The condition of the *walls of the blood-vessels in the vicinity of the cyst wall was remarkable.* Their forms were so changed that at first sight one would think of a pressure toward the periphery having exerted itself on them. It had gone so far that some of the vessels of the tumor appeared as holes or clefts lined with endothelium. Some of them were more or less filled with blood-vessels, and irregularly dilated. The amount of dilatation depended upon the time of their development, and the consequent pressure of the space toward the periphery.

The tumor was everywhere covered with an epithelium of a rather ill-defined character. It consisted of several layers composed of conical, wedge-shaped, and cylindrical cells which ran into each other. It rested on the net-work of fibrous bands from the vessels described above, or on the vessels themselves which reached to the periphery, and again on a true basement membrane which appeared in places.

In the depressions in the tumor, the epithelium was mostly cylindrical in character.

As to the genesis of the spherical space, the condition of the blood-vessels of the tumor, and also their contents, showed that it had its origin in changes in the blood-vessels themselves. We can think of two possibilities. The space could have been produced by a dilatation of a single large blood-vessel, or by many small ones whose walls had become atrophied and finally made to disappear by pressure. Against the first supposition is the fact that the space is far removed from the base of the tumor, and also its large size in comparison to that of the tumor itself.

We are not able to give the genesis of the smaller spindle-shaped space. If we consider the spherical space as a blood-vessel cyst, we can hardly declare the spindle-shaped in the same way. As a short description of the whole tumor the name *angio-fibroma hæmocysticum* does not seem out of place.

CASE 19.—*Angio-fibroma of the the left external canal.*

Mrs. K., æt. twenty-six. Had a discharge for many years. Drum-membrane perforated downward and behind ; operated, June 10, 1872. Several tumors, the largest of which, being 15 *mm.* long and 7 *mm.* broad, was examined. The stroma contained large round and oval cells, mostly containing two granular nuclei. Near the centre its structure was angio-fibromatous. The vessels were seldom filled with blood corpuscles, but often with proliferated epithelium. The portion between the vessels was occupied by bands of fibres which came from the walls of the vessels. Some of the vessels were being obliterated. The smaller tumors showed the same structure as the large one. All were covered with a cylindrical epithelium. *Diagnosis : multiple angio-fibromata.*

CASE 20.—*Myxoma of the labyrinth wall with central cholesteatoma formation.*

A. K., aged sixteen years, had discharge from his right ear for many years. A polyp sprang from the labyrinth wall. Removed, July, 1862, with the snare. Healed with perforation remaining. Size of tumor 17 by 8 *mm.* A macroscopic hole was found in the centre of the tumor, which was almost round, and another irregular one, which was oval. The interior of the spherical hole was filled up with horny cells, and the peripheric portions of the same with Malpighian cells arranged in layers. The horny parts had fallen out of the middle of the irregular hole. Its peripheric zone showed the same structure as the circular one (compare fig. No. 1). The stroma of the tumor was myxomatous ; only a few vessels in the central portions, but they were numerous immediately beneath the Malpighian layer, which covered the whole tumor. The Malpighian layer was everywhere covered with a horny layer. *Diagnosis : myxoma with a central cholesteatomatous formation.*

CASE 21.—*Angio-fibroma of the left external canal.*

A girl, ten years old. Suppurative otitis media with perforation of the drum-membrane behind and below. A tumor on the posterior wall of the left external canal. Operated, Dec. 22, 1872. Size of tumor 18 by 9 *mm.* Large round cells with small cell-body and large nuclei in the centre of the tumor. The remainder of the tumor showed an angio-fibromatous structure, with old and

new collections of blood in all stages of pigment metamorphosis. Even a few hematin crystals were to be seen. The surface of the tumor was covered by cylindrical epithelium in some places; in others, by flat epithelium. *Diagnosis: angio-fibroma of the canal.*

CASE 22.—*Numerous granulation tumors from the roof of the tympanic cavity with central cholesteatomatous formation.*

V. P., a man aged twenty-four. Discharge from left ear for many years. Perforation behind and above. Many small tumors coming out of the drum-cavity. Operated, Sept. 3, 1878. Healing with perforation. Period of observation four years. The tumor was very rich in large cells with nuclei not quite reaching to the cell wall. Blood-vessels very numerous, filled for the most part with blood corpuscles, and partly with proliferated endothelium; seldom obliterated. Numerous blood spots in all stages of pigment metamorphosis. Horny layer on the surface of the tumor. *Diagnosis: granulation tumors from the upper wall of the labyrinth, with central cholesteatoma formation.*

CASE 23.—*Granulation tumor of the labyrinth wall.*

A man, twenty-five years of age. Multiple polypoid formations in the left external canal and in the drum-cavity. Drum-membrane perforated. Size of tumor (of the labyrinth) 22 *mm.* long and 13 *mm.* thick. Operated, June 4, 1874, and treated until June 22d.

The ground-substance was composed of the same cells as in case 22; very rich in vessels. There were papillomatous formations growing into the tumor from the epithelium, composed of cylindrical and flat cells. They contained blood-vessels. *Diagnosis: granulation tumors.*

CASE 24.—*Angio-fibroma of the inner and of the upper wall of the left external canal.*

A boy, fifteen years old. Discharge since childhood. Operated, April 10, 1873, and observed until April 30th. Tumor 9 *mm.* long and 7 *mm.* thick. Numerous cells in the centre; everywhere rich in blood-vessels. In the periphery the cells were replaced by a thick mesh-work of fibres, which came from the proliferated elements of the walls of the blood-vessels. The vessels were, for the most part, obliterated. Vessels anastomosed;

surface, pavement epithelium with horny layer. *Diagnosis: angio-fibroma.*

CASE 25.—*Angio-fibroma of the left labyrinth wall.*

A girl, ten years old. Discharge from left ear since childhood. Multiple polypoid formations in the drum-cavity. Operated, July 17, 1869; observed until Aug. 30, 1869. Size of tumor 10 *mm.* long and 7 thick. Stroma very rich in cells. Same cells as in the last two cases. Very rich in blood-vessels. Vessels filled with proliferated endothelium, and very much thickened by proliferation of the elements of their vessels. Many fibre bands connected with the walls of the vessels. Degenerated pigment patches. Surface, flat epithelium with horny layer. *Diagnosis: beginning angio-fibroma.*

CASE 26.—*Granulation tumor of the right labyrinth wall with central cholesteatoma formation.*

A woman, twenty-five years old. Discharge for many years; and for several months continuous pain in the depth of the ear. Drum-membrane perforated by a development from the labyrinth wall. Operated under chloroform; observed from the middle of June to the middle of July, 1878. Tumor 6 by 5 *mm.* Rich in cells. Cells the same as in case 22. A few normal blood-vessels. Many cones of Malpighian cells which communicate with one another. Central cholesteatoma. Horny layer. *Diagnosis: granulation tumor with central cholesteatoma.*

CASE 27.—*Very large granulation tumor of the right labyrinth wall. Epileptiform attacks which disappeared after the removal of the tumor.*

A man, eighteen years old. Examined in his ninth year at the clinic, Feb. 20, 1865. Found double-sided suppurative inflammation of middle ear, with destruction of the greater part of the drum-membrane; handle of the hammer drawn toward the promontory. Mucous membrane of the latter swollen and grayish red. Left, May 7, 1865. In November, 1874, epileptiform attacks with headache; increase of temperature and pulse; polypoid formation on right side; the tumor extended almost to the opening of the external canal. Operated with the snare, Nov. 24, 1874. Hemorrhage somewhat profuse. Origin of the tumor in the wall

of the labyrinth. Length, 15 *mm.*; thickness, 9 *mm.*; thickness of base, 6 *mm.* Cessation of the headache and the threatened brain complication. Last seen, Feb. 17, 1875. No relapse.

Stroma very rich in cells, same as in case 22. Extraordinary development of blood-vessels, which were closed for the most part by proliferated endothelium, but seldom thickened by proliferation of the wall-elements. Here and there extravasated blood, but without pigment metamorphosis. Flat epithelium with horny layer. *Diagnosis: granulation tumor.*

CASE 28.—*Granulation tumor of the external canal.*

G. S., five-and-a-half-year-old boy. Two years before had otitis med. purulenta dext., with affection of mastoid. Abscess incised by family physician. Cicatrix of mastoid still visible. Oct. 29, 1878, heard badly for a few days before; renewal of otorrhœa on right side; drum-membrane destroyed. Mucous membrane of the promontory red and bleeding easily. Ordered liq. ferri perchlorati (1:5), to be diluted with water, and the ear to be syringed with it. Glands of the neck swollen on right side, Nov. 9th; also the external canal. Stopped the iron; warm water dropped into the ear, Nov. 23d; polyp found in external canal. Nov. 28th, formation of abscess in right mastoid. Removal of polyp and incision of abscess on same day, under chloroform. The knife passed easily through and sank deep into the soft bone. No fever after operation. Dec. 14th, removal of a piece of necrosed bone from the mastoid fistula, and return of polyp. Jan. 25, 1878, treated again at the clinic. The pus which was behind the polyp was washed out through the fistula. *Stat. idem* until Feb. 13th, on which day the polyp came away spontaneously during syringing. Careful cleansing of the ear and wound until Feb. 26th. Numerous granulations springing from carious bone in the canal, which were removed Feb. 27th, under chloroform. On March 11th, a sequestrum, with numerous granulations attached, was removed from canal. March 18th, removal of compact secretion from the fistula, and treated until May 10th. Cleanliness of wound, fistula, and canal kept up by disinfecting lotions. Fistula closed on May 10th; opened again on 13th, and on 15th permanently closed. June 10th, lumen of canal wider. Treated until Nov. 15th with a mixture of salicylic acid and borax. From this time, until the beginning of 1880, treated with boracic acid. The suppuration from the canal never ceased entirely. Last observation, April 31, 1881.

Stroma of tumor rich in cells and blood-vessels, and numerous Malpighian cones passing into it. Concentric layers of epidermis over the superficial parts and so-called pearl nodules (fig. 10). Horny layer. *Diagnosis: granulation tumors from a carious external canal.*

CASE 29.—*Fibroma of the drum-cavity.*

A woman, aged forty-three. Discharge from the right ear for many years. A large lobulated tumor, originating in the tympanic cavity and passing through a perforation in the drum-membrane, reached almost to the orifice of the external canal. Operated, Jan., 1878, with the snare. Length of observation two months. No relapse. Size of tumor 18 by 11 *mm.* Stroma: large, round, and spindle cells, and numerous heaps of cells around the blood-vessels; in many places the spindle cells transformed to connective tissue, which gave the tumor a fibrous appearance near its surface. Vessels almost entirely wanting in this part; in the rest of the tumor they were frequently obliterated by proliferated endothelium. Several layers of pavement, with occasionally a single layer of cylindrical, epithelium. There was only here and there a single layer of horny cells. In many localities the pavement epithelium sent cones into the tumor, with cholesteatoma formations in places. In the stroma of the tumor were isolated patches of black pigment granules; sometimes disseminated, sometimes in heaps. *Diagnosis: fibroma of the drum-cavity.*

CASE 30.—*Fibroma of the external canal.*

A woman, aged twenty-seven. Discharge from the right ear for five years; pain and hemorrhage for eight days. Tumor in the inferior-posterior part of external canal. Operated, Jan. 7, 1879, with the snare. Copious hemorrhage. Left treatment after operation. Tumor 6 by 4 *mm.* Stroma showed large round cells, with nuclei reaching almost to the cell walls. Was traversed with numerous small and large blood-vessels, few of which contained blood, the majority filled by proliferated endothelium. The wall-elements of many were also proliferated, forming fibre net-work in such places, giving, as in the former case, a fibrous appearance to the tumor on its surface. The surface showed a more or less broad Malpighian and horny layer. *Diagnosis: fibroma of external canal.*

CASE 31.—*Granulation tumor of external canal.*

A man, seventeen years old. Discharge from his right ear for six months. Polyp behind and above at the inner end of the canal; drum-membrane perforated behind and in front of the hammer; the latter was preserved. Operated with the snare, Nov. 12, 1878. Copious hemorrhage. Commencement of a relapse Dec. 10th. Treated with alum and acetate of lead. Size 9 by 5 *mm.* Very rich in round and oval cells, and many unchanged blood-vessels. The surface had a single layer of cylindrical epithelium with numerous depressions which give it a ragged appearance. *Diagnosis: granulation tumor of canal.*

CASE 32.—*Granulation tumor of external canal.*

A man, twenty-eight years old. Had an acute inflammation of the middle ear eight years ago. Discharge until Oct., 1875. Return of pain on right side and formation of an abscess in the right mastoid. Abscess opened. In the course of the year 1876, fistula remaining open, increase of secretion, and attacks of vertigo. Trepanation of the mastoid at the surgical clinic without complete cure. Visited the aural clinic, Aug., 1876, when the wound in the mastoid was not yet closed, and discharged pus on pressure. Further examination showed perforation of the wall of the canal, with granulations around the perforation. Perforation of drum-membrane in its posterior-superior quadrant, with granulations coming from the middle ear. The tumors were removed with the snare, and the remains treated with lapis. In syringing the mastoid, water passed into the canal. A sound could be passed 3.3 *cm.* into the fistula. By Politzer, air comes out of the fistula. Granulation returned in the middle ear, Oct. 5th and Nov. 2d. Removed again with the snare. In the meantime vertigo, vomiting, and pain in the right side of the head without chill or fever. Nov. 2d, pulse, 76; temp. 37.2°. Loss of appetite. Tongue coated. External canal and mastoid still communicate in syringing, Nov. 13th. After removal of the granulations with the snare, the discharge decreased; otherwise *stat. idem.* Patient left until Dec. 13, 1878. Return on this day with a new abscess in his right mastoid with two fistulæ; also multiple granulations in the canal and middle ear. Said that the old cicatrix on the mastoid gave way fourteen days before. After removing a large tumor (which was examined) from the external canal, and two which were at-

tached to a sequestrum from the anterior wall of the mastoid, the old scar on the mastoid was opened down to the bone, in order to establish a free communication between the mastoid and the external canal (done under chloroform). He again left treatment at this time. Size of tumor 13 by 6 *mm.* Stroma rich in cells and blood-vessels; the latter stopped up in many places by proliferated epithelium; numerous central cholesteatomata and degenerated pigment patches. Rete Malpighi with horny layer. *Diagnosis: granulation tumor.*

CASE 33.—*Angio-fibroma of the labyrinth wall.*

A man, forty years old. Discharge from his left ear for many years; perforation of the drum-membrane; tumor springing from the labyrinth wall; operated with the snare, Oct. 8, 1879. Cure with hole remaining in the drum-membrane after three weeks' treatment. Last seen, end of Oct., 1871. Size of tumor 9 by 6 *mm.* Stroma rich in cells and blood-vessels. Latter often filled by proliferating endothelium. Proliferation of the walls, and thickening by new-formed connective tissue. Fibrous bands pass out from the walls, and sometimes anastomose. Isolated pigment patches. Malpighian and horny layers. Cylindrical epithelium in places. *Diagnosis: commencing angio-fibroma.*

CASE 34.—*Myxoma.*

A girl, ten years old. Discharge from right ear for five years. Multiple polyps; some in canal, some in middle ear. Operated on, July 23, 1873, under chloroform. No return. Observed until Nov. 1, 1873. Only the larger tumor (14 by 11 *mm.*) from the canal was examined. It consisted for the most part of myxomatous tissue. Many metamorphosed blood extravasations. Pavement epithelium of many layers on the surface, and many chains of non-nucleated cells which were detaching from the surface. Cylindrical cells in the depressions of the tumor. *Diagnosis: myxoma.*

CASE 35.—*Granulation tumor with horny layer.*

A girl, six years old. Had scarlet fever in April, 1878; unconscious for fourteen days; convulsions during the latter part of her unconsciousness. Discharge from her right ear, which was said to have continually decreased. The external canal was

shut off from the deeper parts of the ear by a thin funnel-shaped pseudo-membrane, which was perforated in its centre. There were granulations interior to this membrane, which were removed with a snare on Feb. 3, 1880, and afterward several times cauterized with galvano-cautery. A free exit of pus was thereby established, and the probe could be inserted through the opening in the pseudo-membrane. After-treatment consisted of a 10 % solution of acetate of lead, and cleansing the ear partly with boracic acid and partly with salicylic wadding; the latter was carried through the hole in the pseudo-membrane. No return of the tumor. Two years after there was still discharge, and the membrane was in the same condition as before. *Diagnosis: granulation tumor with horny layer.*

CASE 36.—*Granulation tumor with horny layer.*

A boy, ten years old. Discharge from the ear for several years; tumor originated from the right labyrinth wall. Operated with the snare, under chloroform, Mar. 11, 1879. Size 9 by 6 *mm.* Stroma rich in cells and vessels; many Malpighian cones passed into the tumor body. Horny layer on the surface. Numerous degenerating blood extravasations. Relapse in fall of 1881. The large tumor, which reached almost to the external orifice of the canal, came away spontaneously after nine applications of a 25 % solution of acetate of lead (ten drops of acetic acid added). *It was perfectly black;* no hemorrhage. No return up to his last visit, Mar., 1882. The microscope showed the stroma rich in cells and vessels. *On the surface were collections of black granules (sulphate of lead); the vessels were all filled with blood corpuscles, which adhered to each other, and their forms correspondingly changed. The cells of the tumor were notched and shrunken, with nuclei often indistinct.* (The result of the medication.) *Diagnosis: granulation tumor with horny layer.*

CASE 37.—*Angio-fibroma with partial ossification and central cholesteatoma. Polyp originating from the labyrinth wall of left ear. Operation. Four years later retention of pus (caries?). Three weeks after the operation, return of the tumor; death after the appearance of intense pain, delirium, and loss of consciousness. No post-mortem. Supposed cause of death, cerebral abscess.*

Mrs. C. P., aged sixty-five, first appeared Oct. 22, 1874. She had had a painless discharge from her left ear for several years.

There was a polyp from the labyrinth wall, which was removed by the wish of the patient. She was satisfied with the result, and returned to the clinic four years later, July 13, 1878. She then complained of a severe pain in the depth of the left ear, which had been incessant for three weeks; also of noises in the same ear, and vertigo. Functional examination showed total deafness in the left ear for air- and bone-conduction; yet she said she could hear the watch on contact. There was a pale-red tumor which filled the canal; it was covered with pus. The tumor was removed with Wilde's snare; moderate bleeding. The polyp was hard, and measured 10 by 5 *mm.* Syringing removed thick pus and epithelial cells.

July 16th, patient visited the clinic the last time. She had continuous pain in the left ear, which radiated toward several points of the skull. Sick at the stomach, and constipation for three days. External canal constricted in its centre; pain on pressure on the tragus. Ordered lukewarm water; two leeches on the tragus; ice applications to the head; and two doses of calomel and jalap. Later, obstinate vomiting, evacuation of bowels, cessation of headache, but continuation of pain in the ear.

July 21st, vomiting ceased; one stool; patient delirious and unconscious. The pupils equally contracted; pulse, 100, and weak; temperature, 37.4°. External canal swollen; return of polyp; slight discharge. Used catheter and syringed the ear. Ice; calomel. She was conscious during visit, but a few hours after, delirious, and unconscious, which lasted for a whole week. No stool during the time.

July 26th, temperature, normal; pulse, 120. Pupils, same. No vomiting, nor stool. Ear same as before. Ordered ice, calomel, 0.2., three doses. These symptoms having continued up to Aug. 3d, she died. *Post-mortem* refused.

The tumor consisted for the most part of Malpighian cones, which went into it from the surface; in the centre these cells had degenerated to a cholesteatomatous mass (compare fig. 7). Other parts of the tumor, *e.g.*, the superficial portions, showed a fibromatous structure; the ground-substance, composed of large round cells, between which were the capillaries filled with blood, and endothelial cells. They were in the form of a net-work, with narrow meshes, some of which could be followed to the perithelial sheath of the neighboring vessels, where they passed into them with widened calibre. The middle of the tumor had further characteristics, as: *a*, blood extravasations in the different stages of

pigment metamorphosis; *b*, several places of ossification. The greater part of the extravasations showed mulberry-shaped red globules, which resembled hæmoglobin. They sometimes appeared as if they contained red blood corpuscles, sometimes black, granular, or diffused pigment, and less frequently oblique, rhomboid, brownish-red or brick-dust colored columns. At rare intervals there were spindle or star-shaped pigment cells. In some sections the pigment could be found in the Malpighian cells up to the topmost layer. Notwithstanding the extensive deposits of pigment, only in the great minority of the numerous sections could a blood-vessel be found in the vicinity. In the new-formed bony tissue two separate zones could be easily distinguished. The inner measured (in eight sections) on the average, 0.26 by 0.095 *mm.* In carmine preparations it contrasted with the surrounding parts by a more intense coloring. The ground-substance was homogeneous; the bone corpuscles were star-shaped in the middle, and some in the periphery were round, spindle-shaped, or oval. This inner zone showed a zig-zag contour around its whole periphery. External to this was a narrow pale-red zone, with round and oval cells, impregnated with salt solution, to be recognized. Around all of this was a layer of spindle cells, which separated it from the rete Malpighi above, from the cones to the sides, and from the blood extravasations below.

As to the formation of bone, we can imagine two possibilities. The tumor originated from the mucous membrane of the labyrinth wall. Since this plays the part of periosteum, it is possible that when hyperæmic it formed bone directly. Against this idea is the small quantity of bony tissue, and also the fact that polyps originate here most frequently, and bone should therefore be oftener observed.

More probable is the theory, that we had to deal with a heteroplastic new formation, and a bony formation from connective tissue, or from a part of the ground-substance.

The whole tumor may be described as an *angio-fibroma with central cholesteatoma and partial ossification.*

CASE 38.—*Granulation tumor of the labyrinth wall.*

A man, twenty-one years old, had discharge from both of his ears since his sixth year. Said it came after convulsions. A tumor from the right labyrinth wall was removed with the snare

on April 29th. Size 5 by 4 *mm.* After-treatment: galvano-cautery, and acetate of lead (10 % left, 20 % right). Cessation of discharge, May 10th. *Diagnosis: granulation tumor with cylindrical epithelium.*

CASE 39.—*Myxoma of right labyrinth wall.*

Young man, aged seventeen. Discharge from right ear for many years. Large tumor springing from wall of labyrinth. Operated, May 25th; last seen, June 21, 1874. Size 16 by 8 *mm. Diagnosis: myxoma with Malpighian and horny layers.*

CASE 40.—*Angio-fibroma of external canal.*

A girl, sixteen years old. Aural discharge. Said she heard badly only with the right ear. Tumor at the inner end of canal, above. Perforation of drum-membrane in the centre. Marked hypertrophy of tonsils. Tumor and tonsils operated, Nov. 27, 1877. After-treatment: partly cauterization, partly acetate of lead up to middle of Jan., 1878. Size of tumor 6 by 4 *mm. Diagnosis: angio-fibroma with horny layer.*

CASE 41.—*Granulation tumor of labyrinth wall.*

Young lady, twenty-seven years old. Discharge from right ear for several years. Drum-membrane perforated. Tumor from wall of labyrinth. Operated with the snare, July 17, 1872. Size 6 by 6 *mm. Diagnosis: granulation tumor with Malpighian and horny layers; cylindrical epithelium in places.*

CASE 42.—*Granulation tumor of left tympanic cavity.*

A man, aged twenty-eight. Discharge from left ear for many years. Multiple polypi in the drum-cavity. First operation, May 22, 1868. Relapse. Operated, July 22, 1872. Tumor 8 by 6 *mm.*, with many vessels stopped up by proliferated endothelium, Malpighian and horny layers.

CASE 43.—*Granulation tumor with central cholesteatoma.*

A girl, twelve years old. Discharge from left ear since childhood. Drum-membrane destroyed. Tumor springing from labyrinth wall in front of the stirrup. Operated, July 16, 1872. A return two years later. Operated repeatedly. Typhoid in 1876.

Frequent returns ; operated, Aug. 6, 1877, and observed until Aug. 12, 1877. On July 20, 1878, relapse. Operated with the snare. After-treatment : galvano-cautery, and 25 % solut. pb. acet. Observed until Oct. 9, 1878. Size of tumor examined, 9 by 5 *mm.* The sections show, macroscopically, a defect 2-3 *mm.* broad, caused by falling out of a mass in preparation. The remaining mass consists of Malpighian cells with nuclei, which, however, color but slightly with carmine. (Beginning cholesteatoma formation.) The ring which surrounds the mass was composed of granulation tissue, with a Malpighian and horny layer. There were numerous degenerated blood extravasations in the stroma.

CASE 44.—*Two tumors :* 1. *Granulation ;* 2. *Angio-fibroma* (*return after three years*).

A man, twenty-two years old. Double-sided discharge for many years. Perforation of the drum-membrane, and polypoid formation from right labyrinth wall. Operated with the snare, Mar. 2, 1873. Size 11 by 7 *mm.* Granulation tumor with proliferated endothelial and adventitia cells ; narrow horny and Malpighian layers. No after-treatment. Return in spring of 1876. Tumor 15 by 7 *mm.*; angio-fibroma with cylindrical epithelium, and great depressions of same, producing lobular structure. No after-treatment.

CASE 45.—*Granulation tumor with beginning cholesteatoma.*

A man, forty-five years of age. Discharge from left ear for ten years ; large central perforation of drum-membrane. Polyp of labyrinth wall. Operated with the snare, June 7, 1868. After-treatment : cauterization, and powdered alum and solution of alum, up to June 30, 1868. Return in April, 1872 ; operated, April 9, 1872. Size 12 by 7 *mm.* After-treatment to June 29, 1872 : acetate of lead. Ground-substance rich in cells, with isolated myxomatous patches ; rich in large blood-vessels filled with blood, and showing some proliferation of endothelium and adventitia. There were many round and oval cavities with thick walls, formed by communicating concentric cells, while the cells in the centre were in the stage of retrograde metamorphosis. (Beginning cholesteatoma formation.) The surface of the tumor, composed of two layers of cells with sharply defined contours. ***Diagnosis : granulation tumor with beginning cholesteatoma formation.***

CASE 46.—*Granulation tumor of the labyrinth wall.*

A boy, eleven years old. Discharge from right ear for five years after measles; polyp of labyrinth wall. Operated, July 2, 1878. Size 8 by 6 *mm.* Granulation tumor with horny layer. (Compare fig. No. 8, and text thereto.)

CASE 47.—*Granulation tumor of the right drum-cavity.*

A man, sixty-four years old. Double-sided discharge from middle ear with perforations. Multiple polyps in the drum-cavity on both sides. One tumor of right side 11 by 6 *mm.* The layer removed when patient left treatment. *Diagnosis: granulation tumor with horny layer.*

CASE 48.—*Secondary syphilis. Double-sided otitis med. pur. with perforation. Polypoid formation. Inflammation of the right labyrinth. Healing with cicatrix, and return of hearing totally lost on right side. Fibroma of labyrinth wall.* (*Syphiloma.*)

T. L., a man, thirty-two years of age. Complained on July 9, 1877, that he had had a discharge from his left ear for eight days, which he said appeared after a cold bath. Examination showed a pale-red polyp at the inner end of the canal in front and above. It was treated for a few weeks with alum and a solution (10%) of acetate of lead, which caused it to disappear. The patient had indolent buboes, and also psoriasis in the hands and on the scalp. In April, 1878, he had syphilitic angina, two months after the discharge from his right ear had begun.

On Apr. 15th, a pale-red tumor could be seen in the right canal. Hearing was lost on the right side, and all bone-conduction for tuning-forks. The tumor was removed with the snare, April 23d. After-treatment: mercurial inunctions and infusum spec. lign.; locally, 10–15 % plumb. acet. On July 11th the eruption and angina had disappeared, but the discharge still continued; the greater part of the drum-membrane was wanting; hammer-handle portion preserved; the mucous membrane of the labyrinth wall covered with blood and pigment. July 17th, profuse, thick, offensive discharge. Liquor ferri perchlor. Aug. 28th, discharge very scant. Alum. Sept., liq. ferri. Oct. 2d, only a part of the promontory the size of a pea was suppurating. Acetate of lead, 10%. Nov. 5th, right ear, *stat. idem.* A new eruption over the whole body

and face and scalp. Rhinitis with slight loss of tissue at the entrance of both inferior nasal passages. Iodide of potash. Dec. 9th, general disease, and also ears much better. Iodide continued.

January 20, 1879, cure with cicatrix and attachment to the promontory. Speech, $\frac{1}{3}$ metre; bone-conduction for C and C^1, not for a^1; the last, *2 cm.* by air. Acoumeter by air-conduction, 0.05; by air- and bone-conduction in the beginning of March, 0.13; speech, $1\frac{1}{2}$ metre; bone-conduction now also for a^1. Return of the eruption on May 23d, without any bad effect on ears. Mercury again, and apparent cure of the general disease, May 22, 1880. A slight anginous difficulty without any specific symptoms. Hearing, right: whisper at 4 *m.* Gargle with iodide of potash containing iodine, June 4th; hearing, 6 *m.* for whisper.

Size of tumor, 1 *cm.* by 7 *mm.* The stroma was composed of thick wavy bands of connective tissue, with small round oval and spindle cells with small nuclei. Toward the periphery the stroma was changed to a net-work, with narrow meshes made by the cement substance between the Malpighian cells; whole protoplasm had for the most part fallen out. The tumor had not many blood-vessels. Where the vessels were found, there were proliferations of perithelium, and accumulations of cells in their vicinity. *Diagnosis: fibroma of the labyrinth wall.* (*Syphiloma.*)

CASE 49.—*Angio-fibroma of external canal.*

John H., æt. twenty-nine, consulted us January 29, 1877. Had discharge from his right ear since his youth. Apparent cessation of same. In the last three months, acute inflammation of the anterior part of the mastoid and the neighboring part of the canal, with acute caries and osteoporosis of the latter, and also a part of the annulus tympanicus. Multiple polyps on the under anterior wall of canal. Enormous quantities of cholesteatomatous masses in the inflamed spaces. Serious brain symptoms. Complete cure, with a remaining defect in the canal and loss of the anvil. Partial return of hearing.[1]

Tumor rich in cells, and covered by a single layer of horny epithelium. Few of the vessels filled with blood; most of them with proliferated endothelium. Extensive proliferation of the perithelial sheath, and occasional anastomosing fibrous bands. *Diagnosis: beginning angio-fibroma.*

[1] For a complete history of this case, see these ARCHIVES, vol. viii, p. 231. S. Moos, "Four Cases of Disease of the Mastoid." Case 1.

CASE 50.—*Angio-fibroma of left labyrinth wall.*

A man, thirty-four years old. Discharge for many years; drum-membrane destroyed; tumor, 7 by 6 *mm.*, springing from left labyrinth wall. Operated, January 24, 1870. No relapse. Ground-substance angio-fibromatous. Malpighian and horny layers. The cells were cholesteatomatous in the depressions of the Malpighian layer. *Diagnosis: angio-fibroma with central cholesteatoma formation.*

CASE 51.—*Granulation tumor on right side, in region of the stapes.*

A man, nineteen years old. Discharge since childhood. Anterior half of drum-membrane destroyed. A tumor, 8 by 6 *mm.*, springing from stapes region. Operated, May 23, 1872. Discharged cured (with defect remaining June 18, 1872). Granulation tumor with horny layer; proliferation of endotheliun of blood-vessels, and degenerated blood extravasation. *Diagnosis: granulation tumor.*

CASE 52.—*Granulation tumor of the labyrinth wall.*

A man, twenty-two years old. Discharge from right ear for many years. Perforation in the superior posterior quadrant; origin of tumor, stapes region. Operated, April 15, 1879. Size, 9 by 8 *mm.* Six days after the operation, had erysipelas capitis, and later, meningitis and nephritis. Healing, with perforation remaining. Structure of tumor as in case 51, with a proliferation of the elements of the walls of the blood-vessels.

CASE 53.—*Angio-fibroma of the labyrinth wall.*

A man, twenty-four years old. Discharge from both ears since childhood. Destruction of inferior half of drum-membrane. Tumor of the labyrinth wall. Operated, July 26, 1876. Size, 9 by 6 *mm.* After-treatment for three weeks: acetate of lead. Said he had a discharge five years later without formation of polypi. Successful treatment with boracic acid. Typical angio-fibroma with horny layer.

CASE 54.—*Spontaneous elimination of a granulation tumor of the labyrinth wall, with fatty degeneration of its pedicle.*

A boy, six years old, consulted us in March, 1873. A large tumor, which filled the external canal, came away by syringing,

without much bleeding. It originated in the labyrinth wall. Greater part of drum-membrane destroyed. Size of tumor, 13 by 9 *mm.* Granulation tumor with Malpighian and horny layers. The majority of the Malpighian cells fatty-degenerated. There were numerous patches in the pedicle of the tumor under fatty metamorphosis, showing fat-granules, fat-globules, and cholestearin crystals. The blood-vessels everywhere filled with blood corpuscles.

The spontaneous detachment of the tumor was evidently caused by the fatty degeneration of the pedicle.

CASE 55.—*Granulation tumor of the right drum-cavity.*

A man, twenty-four years of age. Discharge from his right ear for many years. Consultation, May 17, 1875. A tumor, 9 by 6 *mm.*, which sprang from the labyrinth wall, came away spontaneously while syringing; bleeding. Patient not seen after. *Diagnosis: granulation tumor with horny layer.*

CASE 56.—*Granulation tumor with formation of bone.*

A boy, three and a half years old. Chronic otitis media purulenta for one and a half years. Complete destruction of drum-membrane. Caries with polyp. Inflammation of the membranous labyrinth. Meningitis. Abscess in right lobe. *Diagnosis: granulation tumor, with numerous disseminate bony formations, derived from the cells of the tumor, consequently of a heteroplastic nature.*[1]

CASE 57.—*Angio-fibroma of labyrinth wall.*

A man, twenty-two years old. Discharge from his left ear for many years. Operated, Feb. 20, 1871. Origin of tumor, the left labyrinth wall. Size, 5 by 5 *mm.* No return up to the last visit, Nov. 22, 1874. Tough tumor with few blood-vessels; horny layer. *Diagnosis: angio-fibroma.*

CASE 58.—*Beginning angio-fibroma of labyrinth wall.*

A boy, sixteen years old. Discharge from his right ear for many years. Tumor from the labyrinth wall. Size, 4 by 7 *mm.* Return, one year later. Centre of tumor rich in cells; the rest of

[1] For complete history, see Moos, "Contributions to the Pathology and Pathological Anatomy of the Organ of Hearing," these ARCHIVES, vol. iii, pp. 2 and 173.

it fibrous. Horny layer. *Diagnosis: angio-fibroma of the labyrinth wall.*

CASE 59.—*Beginning angio-fibroma of the external canal.*

A young man, eighteen years old. Acute inflammation of the mucous membrane of his right drum-cavity, with total loss of the drum-membrane during scarlet fever. Later it became chronic. Chronic inflammation of the cells of the mastoid, with numerous fistulæ in the bone, and multiple polyps in the external canal on its posterior inferior wall. Total loss of hearing. Neuralgia supra-orbitalis dextra, with occasional feeling of formication in the right arm and leg, with clonic spasms of same. Permanent relief of the nervous symptoms after deep incision into the mastoid process and removal of the polyps. Most of the latter were removed with Toynbee's lever-ring forceps, only a few being brought away with Wilde's snare. After the removal of the polyps the drum was seen to be totally destroyed, and the ossicles were missing. The drum-cavity and the canal formed one large space without any line of division. Mucous membrane of the drum-cavity thickened and red.[1]

The tumor was cellular, with many fibromatous places. *A beginning angio-fibroma of the external canal; Malpighian and horny layers.*

CASE 60.—*Fibroma of labyrinth wall.*

A cigar-maker, nineteen years of age. Discharge from his right ear for seven years. External canal filled by a large lobular tumor, which was found later to have sprung from the labyrinth wall, with a broad base. Operated, Feb. 14, 1880. Size, 21 by 12 *mm.* After-treatment until March 20th, with galvano-cautery and concentrated solutions of acetate of lead. No return. Stroma fibromatous, with myxomatous places. Several isolated cysts (for the genesis of which see case 13), whose cells were under retrograde metamorphosis. Cylindrical epithelium. *Diagnosis: fibroma of the labyrinth wall.*

CASE 61.—*Angio-fibroma of the labyrinth wall.*

A woman, forty-three years old. Had an abortion fifteen years ago, and discharge from her right ear since then. Operated,

[1] For complete history, see *Virchow's Archiv*, vol. lxviii, on the connection between the diseases of the ear and those of the trigeminus, by S. Moos.

April 2, 1880. Size of tumor, 15 by 6 *mm.* Origin: labyrinth wall: Refused after-treatment. Numerous round and spindle cells in the vicinity of the blood-vessels. Fibrous band passed out in all directions from the vessel-walls, which on account of their size and number gave the tumor a fibrous appearance. Surface of tumor covered by Malpighian and horny layers. *Diagnosis: angio-fibroma of the wall of the labyrinth.*

CASE 62.—*Fibroma of the labyrinth wall.*

A boy, fourteen years old. Discharge from his right ear for nine years, after scarlet fever. Operated, April 3, 1880. Left treatment after the operation. Tumor lobulated; sprang from the wall of the labyrinth. Size, 15 by 7 *mm.* Stroma, for the most part, fibromatous; isolated myxomatous places in the centre. Malpighian and horny layers. *Diagnosis: fibroma of the labyrinth wall.*

CASE 63.—*Fibroma of labyrinth wall.*

A girl, twenty-two years old. Discharge from her right ear since two years old. Double polypoid formation. Origin: labyrinth wall. Operated, Aug. 31, 1880. Size of tumors 16 by 10 *mm.*, and 7 by 6 *mm.* Copious bleeding after operation. Treated until the end of Sept., 1880. Structure of tumor same as case 62, with the exception that there was a cylindrical epithelium. *Diagnosis: fibroma of the labyrinth wall.*

CASE 64.—*Fibroma or the external canal, complicated with a cholesteatomatous perforation of the mastoid.*

A woman, nineteen years old. Came, Aug. 22, 1879. Had ear trouble on her left side since six years old. Repeated opening of abscesses in the region of the mastoid. Aug. 23d, opened the covering of the mastoid and removed a large cholesteatomatous mass from the mastoid cavity (see *Zeitschr. f. Ohrenheilk.*, vol. ix, p. 137, *et. s.*). Operated a polyp on the posterior wall of the canal with the snare on the same day. Still remains under observation. Healed with a large hole, which is open outward, and communicates with the drum-cavity and external canal.

The tumor had a pedicle, and was 1½ *cm.* long and 6 *mm.* broad. *Diagnosis: fibroma with numerous parallel Malpighian cones, with a narrow horny layer on its surface.*

CASE 65.—*Fibroma of the labyrinth wall.*

A man, forty-four years old. Double-sided otitis med. pur. chronica of unknown duration. Admitted, Feb. 18, 1882, Left ear first treated. Posterior half of drum-membrane wanting. Tumor originated from the posterior half of the labyrinth wall. Treated with galvano-cautery until Feb. 28th. Removal of a portion of the tumor, March 4th, with the snare. Five applications after removal, which lasted up to March 16th. The next week, treated with boracic acid. Treated from March 23d to April 18th with a 20 % solution of acetate of lead. Complete cure with cicatrix at the end of April. Right side: large granulations on the posterior superior wall of the canal at its inner end. Defect in the anterior half of the drum-membrane. Cholesteatoma of the tympanic cavity. Healing with cicatrix after burning of the cholesteatomatous mass with galvano-cautery, and also the granulations in the external canal. After-treatment: 25 % solution of acetate of lead. May 23d, both sides cured, and patient discharged after removing both tonsils, which were hypertrophied. *Diagnosis for the tumor on the left labyrinth wall: angio-fibroma with horny layer.*

CASE 66.—*Granulation tumor of the labyrinth.*

A girl, aged twelve. Consultation, Nov. 16, 1878. Discharge from the right ear for one year; mixed with blood for a short time previous to consultation. A large red tumor filled the external canal. Operated, May 20, 1879. Moderately copious hemorrhage. Two tumors from the labyrinth wall; size, 12 by 7, and 12 by 4 *mm.* Perforation of the inferior half of the drum-membrane. After-treatment: concentrated solution of acetate of lead. Complete cure, with cicatrix, by the end of July, 1879. *Diagnosis: granulation tumor, with Malpighian and horny layers.*

CASE 67.—*Granulation tumor in the tympanic cavity.*[1]

A man, twenty-four years of age. First consultation, Aug. 16, 1881. Said he had pain in his left ear for eight days before, after a cold bath. Discharge soon followed. Perforation in the anterior superior quadrant, through which a tumor protruded. Treated with boracic acid, and afterward with concentrated solution of acetate of lead. No result. Galvano-cautery, Aug. 27th, with-

[1] It was not possible to determine the origin of the tumor.

out result. Operated, Aug. 30th, with the snare. Operated again, Sept. 6th, on account of increase in tumor. Sept. 8th, acetate of lead. Sept. 27th, return and application of galvano-cautery, also Sept. 29th and Oct. 1st. Return, Oct. 20th. Snare. Return, Oct. 25th. Galvano-cautery; again, Oct. 29th and Nov. 5th. Return, Nov. 8th; snare; return, Nov. 15th. Jan. 17, 1882, some discharge. No tumor. Last observation. *Diagnosis: granulation tumor with horny layer.*

CASE 68.—*Granulation tumor of the canal.*

A man, seventeen years old. Discharge for four years. Tumor at the inner end of the canal. Central perforation of the drum-membrane. Removal of tumor with the snare, July 18, 1880; size, 7.5 by 5 *mm.* After-treatment: 25 % solution of acetate of lead. Healing of perforation, Sept. 4th. Discharged cured. *Diagnosis: granulation tumor with cylindrical layer; also a few goblet-shaped cells.*

CASE 69—*Granulatiou tumor of the labyrinth wall.*

A man, twenty-six years old. Discharge which had become acute, since Dec., 1878. Tumor of the labyrinth operated, April 29, 1879. Patient left off treatment. Size, 8 by 4 *mm.* Granulation tumor, with Malpighian layer; the cells were sometimes fatty, forming large circles, which were confluent in the mass of the tumor. *Diagnosis: granulation tumor.*

CASE 70.—*Granulation tumor of the labyrinth wall.*

A boy, fourteen years old. Discharge from his right ear for two years. Many polyps springing from the labyrinth wall. Central perforation of the drum-membrane. Operated, Sept. 13 and 25, 1879. Treated until Oct. 25, 1879, with galvano-cautery and boracic acid. Healing, with perforation. Size of the tumors, 6 by 5 *mm.*, and 6 by 4 *mm.* Both granulation tumors, with horny layer. Blood extravasations in both.

CASE 71.—*Granulation tumor of the labyrinth wall.*

A boy, fourteen years old. Left-sided discharge for three or four years, after cold baths. A lobulated tumor extended to about the middle of the canal. Central perforation. Origin: promontory. Operated, June 26, 1879. After-treatment: 10 % solution

of acetate of lead. Healed, with cicatrix in drum-membrane. Attachment of handle to promontory. Size, 7 by 4 *mm.* Granulation tumor with cylindrical epithelium. Several blood extravasations.

CASE 72.—*Granulation tumor of the labyrinth wall.*

A young man, eighteen and a half years old. Double-sided discharge for many years. Large defects in both drum-membranes. Right: cholesteatomatous formation. Left: polyp with broad basis. Operated, Aug. 26, 1880. Profuse hemorrhage. Size, 6 by 6 *mm.* Granulation tumor with horny layer. After-treatment until Nov. 16, 1880. Healing with perforation.

CASE 73.—*Granulaiton tumor of labyrinth wall.*

A boy, ten years old. Discharge for two years. Large defect in left drum-membrane. Operated, July 22, 1879. Size, 6 by 4 *mm.* Granulation tumor with narrow horny layer. Cured in March, 1880, with perforation.

CASE 74.—(Compare figs. 6 and 6*a*) *Fibroma of the external canal, with necrosis of the central particles of the tumor.*

A boy, twelve years old. Discharge from his left ear for four years. Two large tumors at the inner end of the canal. Operated, March 19th and 22d. Copious hemorrhage. Tumors 24 by 10 *mm.*, and 20 by 11 *mm.* After-treatment: 25 % solution of acetate of lead. Complete cure by the beginning of April of same year.

Both tumors were unusually vascular. The inner sheath of many arteries was wrinkled. The smaller vessels were mostly filled with blood or stopped up by proliferated endothelium, causing many extravasations. The stroma of the tumors was principally fibrous; their surfaces showing all kinds of epithelium. In the middle of the smaller there was a round spot of about 1 *mm.* diameter, which gave the following condition under the microscope:

The whole field was transparent and was surrounded by a zone of connective tissue, which was lined by cylindrical epithelium in places. With higher powers this substance proved to be a homogeneous hyaline mass, made up of large and small fat-globules, giant-cells, and also of parts which made the impression of amy-

loid bodies; the latter showed all kinds of shapes and forms. The periphery of this locality had a homogeneous fatty appearance, while the interior showed small or large patches of fat-granules, which were found but seldom in the other parts. *Diagnosis: fibroma of the external canal, with necrosis of the central particles of the tumor.*

CASE 75.—*Granulation tumor of the labyrinth wall.*

A girl, eight years old. Discharge from the left ear for five years, after scarlet fever. Operated, Sept. 13, 1879. After-treatment: partly liq. ferri perchlor. and partly boracic acid. Origin of tumor: the posterior half of the labyrinth wall. Posterior half of drum-membrane wanting. Alternate increase and diminution of the secretion until the spring of 1882. Size, 5 by 4 *mm.* *Diagnosis: granulation tumor; communicating Malpighian cones; horny layer.*

CASE 76.—*Granulation tumor of the labyrinth wall.*

A boy, six years old. Diphtheria one year before, and double-sided discharge after, which had been for a short time mixed with blood on the left side. Operated, Nov. 11, 1879. Origin of tumor: the posterior part of the left labyrinth wall. Drum-membrane largely destroyed. Size, 5 by 4 *mm.* *Diagnosis: granulation tumor with a narrow Malpighian and horny layer.*

CASE 77.—*Myxoma of the labyrinth wall, with necrosis of central portions of the tumor.*

A girl, nineteen years old. Discharge from right ear for two years. A lobulated tumor springing from the labyrinth wall. Operated, Dec. 11, 1880. After-treatment: galvano-cautery, and at the end of the month acetate of lead. Last visit, Dec. 28, 1880. Size of tumor, 11 by 6 *mm.* Through growing together of the lobes, there were cavities produced as in case 74 and others. These showed again lobular forms, covered by cylindrical epithelium. As in case 74 there were necrosed parts of the same character, only that they contained tufts of margarin crystals. The stroma of the tumor was myxomatous, very rich in blood-vessels, with many extravasations. Cylindrical epithelium. *Diagnosis: myxoma of the labyrinth wall with necrosis of central portions of the tumor.*

CASE 78.—*Granulation tumor of the region of the stapes.*

A girl, twelve years old. Discharge from her right ear since two years old, after scarlet fever. After the operation a perforation in the drum-membrane was found, through which the polyp had protruded, covering up the rest of the drum-membrane. Operated, April 27, 1880. After-treatment with a 20 % solution of acetate of lead. Complete cure in two months. Cicatrix. Size of tumor, 8 by 6 *mm.* Rich in blood-vessels, which were filled with blood corpuscles, but more frequently stopped up by proliferated endothelium. Walls thick in places. Blood extravasation undergoing alterations; sometimes in the shape of yellow spheres, but most of the cells containing blood corpuscles. Narrow horny layer. *Diagnosis: granulation tumor.*

CASE 79.—*Granulation tumor from the stapes region.*

A girl, fifteen years old. Scarlatina in Nov., 1879. Since that time, discharge from her left ear mixed with blood, especially for a short time before consultation. A tumor protruded through a perforation in the drum-membrane in its posterior superior quadrant. Operated on April 17, 1879. Size of tumor, 7 by 5 *mm.* Healing with perforation. The tumor showed the same structure as case 78. *Diagnosis: granulation tumor.*

CASE 80.—*Granulation tumor of the external canal.*

A man, twenty-two years old. Had diphtheria when four years old. Tracheotomy. Aural discharge. Later, a spontaneous perforation of a mastoid abscess. When fifteen years old, return of pain in the left mastoid process. Incision. When seventeen, pain on left side, vertigo, and brain symptoms. Return of pain on left side three weeks before consultation. Condition, July 22, 1879, as follows: cicatrix on the left mastoid. Left external canal very narrow; beyond the contracted place was a large granulation tumor, beneath which a probe could be passed into the mastoid cavity on account of caries of bone of the canal wall. All tuning-forks heard on right side, where there was only a small part of the drum-membrane remaining near the handle. Granulation removed. Size, 7 by 5 *mm.* Galvano-cautery until Aug. 2d. Further treatment at his home to Oct. 10th with salicylic acid, borate of soda, āā 8 to 200 of water. Oct. 18th, both low tuning-forks heard only on the left by bone-conduction, a^1 only on the right. Voice,

left=0 right=1.0 *m.* There was a tough, pale-red membrane which was sensitive to the touch, stretching across the canal at about the end of the inner third. It had the shape of an anchor (the broad part upward), and lay in an oblique direction from above and behind, to below and in front. There were two holes in it. Through one of them the region of the posterior inferior quadrant could be inspected. Caries cured. *Diagnosis: granulation tumor with caries of the external canal.*

CASE 81.—*Granulation tumor of the drum-cavity.*

A man, twenty years old. Discharge from both ears for seven years. Examined, May 14, 1876. Double-sided otitis med. pur. with perforation and multiple polyps in both tympanic cavities. After removal of the tumors from the right ear, patient left treatment. *Diagnosis: granulation tumor with horny layer.*

CASE 82.—*Granulation tumor of the labyrinth wall.*

A boy, thirteen years old. Otitis med. pur. for three years, with perforation. Polyp from the labyrinth wall. Operated, May 14, 1880. Size of tumor, 6 by 4 *mm.* After-treatment: acetate of lead, for six months, without return. *Diagnosis: granulation tumor, with numerous deep depressions of the cylindrical epithelium.*

CASE 83.—*Granulation tumor of the labyrinth wall.*

A man, thirty years old. Ear trouble since he was eight years of age. Operated, July 5, 1879. The tumor came from the labyrinth, and protruded through a hole in the posterior inferior quadrant. Removed with the snare. Size, 5 by 3 *mm. Diagnosis: granulation tumor with horny layer.*

CASE 84.—*Granulation tumor of the labyrinth wall.*

A girl, twenty years old. Discharge from her left ear ever since childhood. Drum-membrane destroyed up to the handle. Tumor originated in the labyrinth wall. Operated, June 7, 1878. Size, 7 by 5 *mm.* After-treatment: galvano-cautery. No return. *Diagnosis: granulation tumor with horny layer.*

CASE 85.—*Numerous granulation tumors on the wall of the labyrinth, with central formation of cholesteatomata.*

Boy, age eleven. Has had pain in the ear for eighteen months without discharge. For a fortnight has had pain and discharge

from the right ear. Condition : hypertrophy of the tonsils ; the whole of the right *Mt* destroyed, except the handle of the hammer ; multiple polypi in the labyrinthine wall. Operation, under chloroform, Feb. 16, 1880, when ten or twelve tumors as large as a pea or bean were removed. After-treatment, 25 % solution of lead acetate in dist. water. Total cicatrization of the defect ; time of observation, two years. *Diagnosis : granulation tumors with thick horny layers.* Offshoots of the Malpighian layer penetrate into the interior of the tumor and anastomose with one another. Some patches of the same in the interior of the tumor have undergone fatty degeneration.

CASE 86.—*Granulation tumor in the auditory meatus.*

Woman, age sixty-nine. Has had discharge from the left ear for six weeks and pain for three weeks. A polypus at the inner end of the upper wall of the meatus was snared. Subsequent treatment with the galvano-cautery. Complete cure. *Diagnosis : granulation tumor with thin horny layer.*

CASE 87.—*Granulation tumor in the external auditory meatus.*

Girl, age twelve. Central proliferation of right *Mt.* Polypus on the posterior superior wall of the meatus ; operation for removal, Dec. 16, 1879. Measurements, 9 × 5 *mm.* *Diagnosis : granulation tumor with thin horny layer.*

CASE 88.—*Granulation tumor of the labyrinthine (?) wall.*

Girl, age twenty-one, who as a child had been treated at our clinic for perforative inflammation of the left tympanum. Examination, November, 1881, shows : left *Mt*, central perforation, beyond which, and larger than its diameter, two polypi are visible. After using the acetate of lead solution, the operation was performed, Dec. 10, 1881 (the snare being passed through the perforation), and a polypus measuring 6 × 5 *mm.* removed. After-treatment : the acetic lead solution ; perfect cure with cicatrization of the perforation, January 4, 1882. *Diagnosis : granulation tumor* with lobules, which owed their origin to the formation of deep furrows from inward proliferation of the cylinder-epithelium. Numerous hemorrhagic effusions ; black deposits on the surface and in the centre of the tumor (sulphate of lead ?). The most

interesting point is a peculiar turbidity of the cell-protoplasm (probably due to the action of the lead solution).

CASE 89.—*Granulation tumor of the external meatus.*

Woman, aged forty. Has had an ulcer in her right ear for two months. March 16, 1880, a polypus at the inner end of the upper wall of the right meatus was removed with the snare; *Mt* normal. After-treatment with the lead solution. June 22, cure. *Diagnosis: granulation tumor with horny layer.*

CASE 90.—*Granulation tumor of the external meatus.*

Man, age thirty-two. Lost the sight of his right eye by a fall on his head in youth. He now has "a disease of the chest," and claims to have been deaf (with discharge) in his right ear for three weeks. Voice, right 0. All tuning-forks, however, are heard by bone-conduction on the affected side. There is a large tumor on the superior wall of the meatus, springing from the inner end. *Mt* intact. December 8, 1881, the polypus was snared; during the operation the patient was greatly prostrated. After-treatment with the concentrated acetic lead solution. The cure was perfect, but hearing was not restored. Polypus measured 7 × 5 *mm.* *Diagnosis: granulation tumor with a thin horny layer and small extravasations of blood.*

CASE 91.—*Granulation tumor of the tympanum.*

H. S.,[1] æt. five, has suffered since the autumn of 1879 with suppuration from the left ear, due to unknown causes. April 23, 1880, multiple formation of polypi in the tympanum. April 29th, several polypi of various sizes were snared off; galvano-caustic after-treatment. May 8th, symptoms of inflammation in the cells of the left mastoid process, with formation of an abscess. May 11th, rupture of the abscess into the posterior superior wall of the meatus. Despite repeated evacuation of the pus in its interior by pressure on the outer surface of the mastoid process, Wilde's incision became necessary, June 24th. Sept. 25th, the track of the fistula had to be chiselled open and enlarged on account of threatening cerebral symptoms. Oct. 7th, death from miliary tubercle.

[1] A detailed account of this case was published in these ARCHIVES, vol. x, p. 31. Trepanation of the mastoid process; death from miliary tubercle.

The polypi, covered with a horny layer, are composed of granulation-tissue, with numerous Malpighian cones penetrating into the growth and there anastomosing.

CASE 92.—*Granulation tumor of the meatus, with central formation of cholesteatoma.*

Man, age thirty-two. Jan. 23, 1879, has had otorrhœa on the left side since childhood; multiple formation of polypi in the meatus and tympanum (the latter were removed with the galvano-cautery). A large polypus in the inner third of the meatus was removed with the snare (on the same day), and the complicated case, even to total cicatrization of the largely-perforated *Mt*, successfully cured March 18, 1879.

The polypus (15 × 8 *mm.*), with exception of a few myxomatous patches, consists entirely of granulation-tissue, Malpighian layer, with horny envelope; but mostly cylindrical epithelium which has proliferated in the interior, so that the tumor begins to appear lobulated. Indeed some portions of it have already undergone constriction, and seem quite ready to drop off spontaneously. *Diagnosis: granulation tumor of the external auditory meatus.*

CASE 93.—*Fibroma of the labyrinth wall.*

F. W., age twenty-three, has had a discharge from his left ear since the age of five, when he had scarlatina. At the age of thirteen, aural polypus was recognized by a physician. June 22, 1880, multiple polypus, with subsequent enlargement of the auditory meatus. June 23d, part of the polypus snared off, the largest lobe springing from the labyrinth wall being extracted with polypus forceps. It measured 24 *mm.* in length, 12 *mm.* in breadth, 7 *mm.* in thickness, and resembled a raspberry, with its lobes and irregular surface covered with small round cysts. The probe detected rough bone on the labyrinth wall. After-treatment with galvano-cautery, and later with the solution of lead acetate. Aug. 1st, violent pain in the head, paralysis of the left facial nerve. Aug. 21st, death from abscess of the cerebellum.[1] *Diagnosis: fibroma.*

The remaining seven cases were amongst those that we observed and treated. But we are unfortunately unable to

[1] For details of the case, see these ARCHIVES, vol. x, p. 121.

give their history, owing to the fact that the specimen labels were lost during two changes in the locality of the clinic.

CASE 94.—*Granulation tumor.*

Granulation tumor, 8 × 5 *mm.*, with cylinder-epithelium.

CASE 95.—*Angio-fibroma.*

Polypus, 8 × 7 *mm.* Horny layer; part of the Malpighian layer has undergone fatty degeneration.

CASE 96.—*Angio-fibroma with cylinder-epithelium.*

CASE 97.—*Angio-fibroma.*

Tumor, 10 × 9 *mm.*, with very large vessels. Malpighian layer with a narrow horny layer. The cement lines of the penetrating cells of the Malpighian layer form a coarse net-work in which we still see a few nuclei of the original layer.

CASE 98.—*Granulation tumor.*

Tumor, 19 × 7 *mm.*, with a horny layer. Near the surface an extravasation of blood, which has elevated the horny layer. It was probably due to the use of the probe before the operation.

CASE 99.—*Angio-fibroma.*

Tumor, 8 × 6 *mm.* The Malpighian cones penetrate deeply and anastomose with those of the same side, and partly with those of the other. The latter are very sharp. Corneal layer (compare fig. 3).

CASE 100.—*Angio-fibroma.*

Tumor, 10 × 9 *mm.* Fibromatous structure. Endothelial and perithelial proliferation of vessels. Proliferations of the Malpighian layer penetrate into the whole tumor from every side, give rise to furrows, and secondarily to the snaring off of various lobes. (compare fig. 2).

Explanation of the Figures.

Fig. 1; *Fig.* 1, *a*; *and Fig.* 1, *b.*

A portion of the section of the polypus in case No. 20. Hartnack $\frac{8}{7}$. Tube 0. Myxomatous stroma, surrounded at the right

by a Malpighian layer. Beneath it several vessels which are very poorly represented in the stroma itself. One circular and one irregular hole are visible even to the naked eye in the centre of the polypus. The interior of the circular hole is composed of overlying horny plates; the dark peripheral zone, of stratified Malpighian cells (fig. 1, *a*, Hartnack $\frac{4}{7}$). The horny plates have escaped from the interior of the irregular hole. The peripheral zone, which has produced a certain number of offshoots, shows the same cell-formation as that of the circular hole (compare fig. 1, *b*, Hartnack $\frac{4}{7}$).

Figure 2.

Section of the polypus in case No. 100. Hartnack $\frac{4}{7}$. Tube 0. The figure shows almost the entire surface of the tumor. We see the sections of several septa which pass from various sides into the interior of the tumor and partially communicate with one another. In this way, the stroma of the tumor has undergone numerous reduplications, while at the periphery some portions have been strangled away and have fallen off. The structure of the tumor is described in the notes of the case.

Figure 3.

The halves of a section through the polypus in case No. 99 Hartnack $\frac{4}{5}$. Tube 0. The stroma of the tumor is angio-fibromatous. The surface is a Malpighian layer with a horny envelope. Cones pass from the former into the interior of the polypus, and anastomose partly with those from the same side and partly with those from the opposite side. In this way, some portions of the tumor have become isolated, as is particularly visible at the lower margin of the figure.

Figure 4.

About three fourths of a section through one of the multiple tumors in case No. 91. Hartnack $\frac{4}{5}$. Tube 0. The polypus is composed of granulation-tissue alone, and broad, extensively anastomosing Malpighian cones, which appear dark in the drawing, while the stroma of the tumor is bright.

Figure 5.

Central portion of a section through one of the tumors in case No. 13. Hartnack $\frac{4}{5}$. Tube 0. The tumor has numerous recesses and fissures, which like the surface are lined with cylinder-epithelium. The fissures originate from secondary union of the

adjacent surfaces of the indentations (as at *b*). We also find that some parts of the tumor have been strangulated within the fissures by the enormous inward proliferation of the epithelial envelope (as at *a*). This process as well as the secondary disturbances of nutrition have led to necrosis in the interior of the tumor, even without the access of air. The bright portions in the drawing correspond to the granulation-tissue; the dark portions are angio-fibromatous in structure.

Figure 6 *and Figure* 6, *a.*

Part of a section from one of the larger polypi in case No. 74. Hartnack $\frac{3}{5}$. Tube o. We see several cavities of various sizes which have originated in the manner described under fig. 5. Some of these are empty; the two larger contain a substance the microscopic condition of which is shown in fig. 6, *a*. Hartnack $\frac{3}{8}$. Tube o. This exhibits fat globules of various size, while interspersed are seen extraordinary structures, resembling amœboid cells, molar teeth, stars, cactus plants, or multipolar ganglionic cells. The offshoots of these structures give off a homogeneous, brilliant, fatty lustre, while in the interior of the structures themselves we find numerous clumps of fatty granules, which in the offshoots themselves are but occasionally to be seen.

Figure 7.

A portion of a section from the centre of the tumor in case No. 37. Hartnack $\frac{3}{7}$. Tube o. The centre of the drawing shows the mosaic arrangement of the cement lines of the non-nucleated cells, which in turn have originated from regressive metamorphosis of the Malpighian cones, which had once penetrated the interior of the tumor; *in other words, a central cholesteatoma.* Some of the more peripheral cells contain a nucleus. At the right and left of the locality just described, we see the well-preserved cells of the Malpighian cones; at the left, some of the same cells surrounded by an enveloping membrane, and counterfeiting a giant-cell.

Figure 8.

A portion of the centre of the tumor in case No. 46. Hartnack $\frac{3}{7}$. Tube o. Typical granulation tumor. The stroma consists of fibrillar tissue, mostly of round, but partly of oval and spindle-shaped, cells. We also see a large number of blood-vessels which have been divided obliquly, in the centre of the picture one

divided longitudinally. Almost all of the vessels are filled with blood corpuscles or endothelial cells. The walls of some of the vessels have begun to undergo proliferation. (The delicate fibrillar structure can of course be demonstrated only by higher magnifying powers.)

Figure 9.

Part of a transverse section of the tumor in case No. 16. Hartnack $\frac{8}{4}$. Tube o. Three vessels have been divided, mostly filled with blood corpuscles, the outer walls partly infiltrated with cells, and occasionally thickened by proliferation of the parietal elements. Several fibres, broader or narrower, as the case may be, pass from the outer walls in different directions, anastomose with one another, and form a net-work amidst which a few round and oval cells lie scattered (angio-fibroma).

Figure 10.

A peripheral portion of a transverse section of the tumor in case No. 28. Hartnack $\frac{3}{4}$. Tube o. Concentric lamellæ of horny epidermis in the centre of the figure. At their periphery they are sharply separated by a bright space, from a circular layer of Malpighian cells. The whole appearance greatly resembles the "pearl nodule" seen in cancroids. At the right and left we see the faint clubs and cones of the Malpighian cells extending inward from the surface. The remainder of the growth consists of granulation-tissue. The surface bears a thin horny layer.

Figure 11.

Section through the *whole tumor* in case No. 17. Hartnack $\frac{2}{4}$. Tube o. The structure is identical with that of case No. 9 (angio-fibroma). The surface consists of a comparatively thin Malpighian layer, which in the middle of the edge of the section sends more or less deep offshoots into the interior of the tumor. The black contour on the surface represents the narrow strip of cornified cells (epidermoidal transformation of the mucous membrane of the labyrinth wall). The anastomosing cords of the Malpighian layer have already prepared for the imminent strangulation of a small portion of the tumor.

GENERAL REVIEW.

The sex of the patients was as follows: 66 males; 27 females; 7 not noted.

The age of the patients may be tabulated thus:

Between	1	and	10	years	12 cases.
"	10	"	20	"	36 "
"	20	"	30	"	23 "
"	30	"	40	"	9 "
"	40	"	50	"	9 "
"	50	"	60	"	1 "
"	60	"	70	"	3 "
Unknown					7 "

Only sixteen cases of suppurative inflammation leading to the formation of aural polypi could be precisely ascribed to infectious diseases, viz.: ten to scarlatina; two to diphtheria; and one each to typhoid, measles, variola, and syphilis. We are of the opinion that there ought to have been more cases than these (with infectious diseases as the cause), but we must remember that many years may elapse between the origin of the affection and the consultation with the aurist, so that the patients have forgotten the original cause. And again, they often come to us, unaccompanied with parents or relatives who could give us more exact information upon the especially interesting question of the etiology of the disease now under discussion. Nevertheless, it is worth noticing that, in agreement with facts noted by other observers, we found scarlatina to be the most frequent cause.

The polypi were *single* in eighty-one cases, *multiple* in nineteen. The multiple polypi occurred occasionally in the meatus alone, occasionally in the tympanum alone, six times in both simultaneously. *Otorrhœa was absent in only a single case* (case No. 11).

The tumor was located twenty-five times in the meatus, once (case 11) close to the orifice of the meatus. In all the other cases it was deep-seated, usually close to the *Mt*; in the tympanum sixty-eight times; once on the roof, otherwise on the wall of the labyrinth; eight times near the stapes.

Not a single polypus in our series of cases sprang from the *Mt* itself, nor even from the handle of the hammer. These localities are occasionally, though rarely, affected.

Amongst the ninety-three cases in which the condition of the *Mt* was noted, in only nine could it be considered absolutely *intact*; in other words, it was perforated or destroyed in eighty per cent. of all our cases of polypus. This is a fact which shows that the prime cause of the formation of polypi is to be sought for in suppurative inflammation of the tympanum; it also explains the extremely frequent origin of the tumor from the mucous membrane of the drum, especially from the labyrinthine wall. It is one of the greatest of rarities to discover a polypus which did not owe its origin to a previous suppurative inflammation.

The number of cases in which a *relapse* was undeniable was eighteen. The shortest interval between the operation and the relapse was one month; the longest, nine years.

Twenty-nine cases were *perfectly cured;* many of the patients were satisfied with the simple removal of the polypus, and did not return for after-treatment at all, while some of them left our care even when we knew that suppuration was still present.

Five polypi came away after simply syringing the meatus. A relapse was noticed in three of these cases. One of the five had been previously treated with the concentrated lead solution (case 36). In another, fatty degeneration of the tissues in the pedicle was observed (case 54). In the other three cases, excessive hemorrhage followed the removal of the tumor.

Ten polypi were accompanied with caries: six of the mastoid process alone; one of the meatus and the middle ear simultaneously; one of the labyrinthine wall; one of the pyramid; and one of the meatus, the mastoid process, and the pyramid together.

Four of the cases (27, 32, 49, 59), were *accompanied with cerebral symptoms before the operation.* The immediate cause in all of these cases was the hindrance to the outflow of pus by the tumor, for when the latter was removed and a free exit established for the pus, the cerebral symptoms disappeared without any other treatment. The symptoms referred to consisted chiefly of genuine epileptic attacks, headache, vertigo, vomiting, supra-orbital neuralgia, and

clonic spasms, etc., in the region of the extremities of the affected side.

The accidents that ensued *after the operation* (removal of the growth with Wilde's snare) must be partly ascribed to the operation itself. Amongst these we had: in case 90, fainting; in case 6, paralysis of the sense of taste (probable injury of the chorda tympani while snaring the tumor); in case 56, erysipelas[1] started from the operated ear, and was accompanied with meningitis and nephritis. The complications subsequent to the operation are partly referable to the accumulation of pus (facial paralysis in case 15), and partly to the long duration of the suppurative inflammation which accompanied or gave rise to the polypus. In two cases, with or without caries, there was meningitis alone, cerebral abscess alone, and finally both together (cases 37, 56, 93). The tubercular meningitis which was observed in case 91 must be regarded as entirely accidental, and quite independent of the other symptoms in the case.

CLASSIFICATION OF THE POLYPI ACCORDING TO THEIR STRUCTURE.

Aural polypi have hitherto been classified as round-celled, fibromatous, myxomatous, angiomatous, and mucous or muco-glandular. But our series of cases seems to show that the name mucous polypi must be abandoned (at least so far as concerns *aural* polypi), for to say nothing of the entire absence of glands in the mucous membrane of the tympanum, the tissues in these polypi, which former authors regarded as tubular glands, are simply cavities formed by the inward proliferation of the epithelium (formation of fissures and indentations), and at a later stage, partial covering in of the tissues of the tumor themselves.

The name "angioma," although no polypus of such a structure was discovered in any of our present list of cases,[2] must still find a place in the nomenclature of these tumors, although of rare occurrence. Buck[3] was the first to show

[1] The operation in this case was very easily and rapidly performed, but erysipelas was then epidemic in the town, and particularly in the hospital.

[2] Yet we saw four cases of exquisite cavernous structure in the pedicles of tumors.

[3] These ARCHIVES, vol. 2, part 1, page 72.

that angioma may spring even from the handle of the hammer itself, and that the vessels of the hammer by taking a pre-eminent share in the development of the tumor give to the neoplasm its distinctive anatomical character. Moos[1] has since observed two similar cases.

It is important in a clinical point of view to notice that all of these tumors may be followed by excessive hemorrhage during the operation, or by secondary hemorrhage, which demands so heroic a procedure as tamponage of the meatus. In this respect, however, the benignant angiomata do not essentially differ from certain malignant forms which are occasionally observed in the human meatus.[2] We adopt the rest of the customary nomenclature, except that we call the common "round-cell polypus" "*granulation tumor*," and subdivide the fibromata into pure, and so-called angio-fibroma.

Our list may be classified as follows:

Granulation tumors	55
Angio-fibromata	27
Fibromata	14
Myxomata	4
	100

Granulation tumors.

The account of the cases and the accompanying figure (8) satisfactorily show why we prefer the name "granulation tumor" to the hitherto accepted designation "round-cell polypus." All of these neoplasms exhibit the exquisite structure of the so-called granulation tumors, characterized in the first place by a delicate fibrillar fundamental tissue; secondly, by a number of cells which are mostly round, partly oval or spindle-shaped; and finally by numerous blood-vessels, which are sometimes filled with blood and sometimes with endothelial cells. These granulation tumors represent at the same time the transition step in the development of

[1] These ARCHIVES, vol. 3, page 107, and *Virchow's Archiv*, Band lxviii, case 6.

[2] Politzer: Lehrbuch der Ohrenhlkde., Band ii.

Angio-fibromata.

When granulation tumors have lasted for some length of time, the elements of the vascular walls particularly begin to undergo proliferation (compare, *e. g.*, case 45), the preliminary stage of which can frequently be discovered on examining aural polypi. If the operation is not now undertaken, the angio-fibromata develop according to the following type: The cells of the adventitious sheaths (perithelial tubes) of many of the vessels begin to proliferate, and thus to produce an anastomosing series of cellular strands which form a narrower or wider net-work, as the case may be. At the same time, the endothelium proliferates and the vascular walls increase in thickness. If this process advances still further along the vessels, they may in time become entirely obliterated, so that at a later stage the tumor is very poor in blood-vessels. The anastomosing cellular strands simultaneously thicken, their cellular elements becoming transformed into spindle-shaped cells, and later into connective-tissue fibres. The result of this process is that we get a picture of a tumor with coarse fibres, very poor in cells and blood; one whose development from vessels can only be demonstrated by the presence of a few of the latter clogged with blood or undergoing obliteration (compare fig. 11, from case 17). The view above expressed seems to be supported by the fact that in the case of a relapse after the operation upon granulation tumors the new polypus is frequently of angio-fibromatous structure (compare, *e. g.*, case 44).

If we compare the condition of things in our case with the description of angio-sarcomatous growths (cylindroma, cylinder tumors, cylindrico-cartilaginous tumors, etc.) as given by other authors,[1] we cannot deny that both varieties of tumor greatly resemble one another as well in development as in structure. In the classical angio-sarcoma we also have a neoplastic formation of cellular strands from the walls of the vessels, and subsequent metamorphosis.

Clinically, however, these two forms of tumor are differen-

[1] Compare the careful anatomical paper with bibliography by Kolaczeck, "Ueber das Angiosarcom," *Deutsche Zeitsch. f. Chirurgie*, Band ix (1878), page 1, continued on page 165.

tiated by the fact that angio-fibromata of the ear never infect the neighborhood of their native soil, and consequently never appear as secondary affections, which, as is well known, is occasionally the case with angio-fibromata of other regions. For these reasons we have chosen the name angio-fibroma instead of that of angio-sarcoma, *but that title should be strictly reserved for such tumors as are developed from blood-vessels.* A tumor with cavernous spaces should not be called an angio-fibroma.

It sometimes happens (case 18) that a cyst becomes developed from the blood-vessels of the tumor.

Fibromata.

Clinically and macroscopically, the fibromata are not to be differentiated in any way from the so-called angio-fibromata, but *genetically* there is a decided difference, for while the blood-vessels take a *direct* share in the development of the angio-fibromata, they are only indirectly connected with the development of the fibromata. Fibromata are developed especially from the formative cells which have wandered from the blood-vessels. We frequently see these cells lying in heaps closely adherent to the walls of the vessels or very near them, and it is from these that the spindle-shaped cells are developed, and from these in turn the connective-tissue fibres which predominate in the stroma of the tumor and give it its peculiar appearance. Whenever the spindle-shaped cells do not undergo further metamorphosis, so-called myxomatous portions remain and are frequently discovered in the tumor as "disseminate myxomatous patches."

Myxomata.

Our cases of myxomata were as rare as those discovered by Steudener, only four in one hundred. A pure myxoma in aural polypus is very rare. Three of our cases originated in the tympanum, the fourth in the external meatus. It is quite probable, so far as concerns pure myxoma originating in the tympanum, that the irritation appertaining to suppurative inflammation of the tympanum led to the develop-

ment of this peculiar tumor from some remnants of those mucous tissues that had outlasted fœtal life.[1]

The epithelium of the polypi.

Sixty-eight of our series of one hundred polypi had a Malpighian investing membrane with its horny layer; eighteen, a cylinder-epithelium; three, a cylinder- and ciliated epithelium alike; while eleven exhibited all of the well-known varieties of epithelium, variously arranged. The latter cases have convinced us of the important influence exercised by the mechanical relations (pressure of the various portions of the tumor upon one another and dislocation particularly in the case of large tumors) upon the occurrence of various forms of epithelium. The Malpighian layer, for instance, offers extensive variations in thickness, whilst the shape of the surfaces of the tumor which it covers differs extraordinarily in nearly every tumor. Thus the surface terminates occasionally in elevations and depressions like waves, and then again in sharp-pointed papillæ, the summits of which are wreathed with vessels. At another spot, the surface is entirely smooth, and the Malpighian layer stretches evenly across it, occasionally sending into the interior of the tumor more or less sharp or blunt offshoots which here and there anastomose with those of the same side or also with similar ones from the other (case 91, fig. 4; case 17, fig. 11). The more tumors we examine the more vivid becomes the impression that these offshoots are the original cause of the subsequent formation of lobes and folds in the tumor,[2] as well as the separation of entire portions of the polypus, for when the centre of the cones which are made of Malpighian cells undergo cornification and the cornified layer drops off, the tumor splits.

This view is further confirmed by the formation of

Central cholesteatomata.

which we found in ten cases in the centre of the tumor, besides clumps of cholesteatomatous plates which in other

[1] Compare Cohnheim's views on the etiology of neoplasms. Allgemeine Pathologie, 2te Theil.

[2] These ARCHIVES, vol. viii, p. 280.

portions of the tumor formed round or circumscribed islets, depending upon whether the offshoots from the Malpighian layer had been divided obliquely or parallel to the long axis. These pictures vary greatly, depending upon the number and form of the cones that have been divided by the section, but still more upon the fact that the epidermoidal cells of which the cones are composed are discovered in various stages of transformation and cornification. It therefore happens that in the centre of a section we see the non-nucleated cells with their cement lines arranged in mosaics (fig. 7, case 37), or again round, irregular fissures[1] (which are due to the loss of cornified portions) surrounded by a wreath of well-preserved Malpighian cells (compare fig. 1, *a*, and 1, *b*, case 20). In other sections, the cells which lie within the sections of the cones are still unaltered, the latter being then easily recognized as deeper tinted islets, resembling giant-cells within the tissues of the tumor (compare case 37, fig. 7, to the left in the drawing).

When several adjacent cones have been divided obliquely or longitudinally by the section, we have of course the greatest variety of pictures, particularly in tinted preparations, depending on the stage of the transformation: whitish-yellow, colorless clumps and long lines of cornified cells surround the sections of cones which are still intact or just about to undergo transformation (fig. 7). In the centre of these clumps we still can discern a considerable number of cholesterine plates, despite the preliminary hardenings by alcohol. We moreover find extravasations of blood, blood corpuscles, organized cells, pigment, while the cholesteatomatous clusters are occasionally permeated with hæmatoxylin. On this point we shall speak more particularly in discussing the presence of hemorrhagic extravasations in the polypi.

The epidermoidal transformation of the tympanic mucous membrane

is worth noticing in a practical point of view, in so far as it gives rise to unusually frequent relapses of polypi in this locality (compare case 17).

[1] In many cases even with the naked eye.

When this alteration of the tympanic mucous membrane takes place, it results in a neoplastic formation of papillæ like those of the cutis, except that the intervals between them as well as their surfaces are covered with Malpighian cells and a horny layer. In just the same way as papillæ of the cutis, under certain circumstances, are transformed into warts, so polypoid growths originate from corresponding alterations in the mucous membrane of the tympanum. It is these growths which, despite their minute size, offer an obstinate resistance to radical removal, and all the more since they are preceded by a small-celled infiltration of the epidermoid layer, from which a chronic inflammatory condition is set up and persists indefinitely.

SPECIAL HISTOLOGICAL CONDITIONS IN THE POLYPI.

I.—*Hemorrhagic extravasations and pigment metamorphosis* are frequently observed in aural polypi; they are sometimes circumscribed, and sometimes diffuse. The more immediate causes of their origin are:

1. Increased vascularity.
2. Obstruction of the vessels by endothelial proliferation in cases of tumors of rapid growth.
3. Thinness of the vascular walls (giant capillaries).
4. Regressive metamorphosis of the stroma and secondary alterations in the tension of the interior of the tumor (especially in the case of central formation of cholesteatomata).
5. Mechanical influences before the operation (such as probing the polypus), or even the operation itself (snaring).

Pigment in every variety was observed, hæmin-crystals included (compare the various cases).

II.—*Neoplastic formation of bone in the polypi* was observed in three cases (16, 37, 56). The encapsuled pieces of bone were sometimes single, sometimes multiple; in case 56, they were seen at both the centre and periphery of the tumor. This neoplasm must be regarded as *hetero-*

plasia. The histological details can be found in the notes of the various cases.

III.—*Central necrosis*

was observed in two cases (13 and 74; compare also fig. 6, and fig. 6, *a*).

Origin of the necrosis.

When the raspberrylike lobed polypi increase in size, the tips of the larger lobes occasionally grow together, and the tumor develops itself further and further outward from this place of union. But in the interior of the growth has thus originated a cavity which now includes the smaller lobes which were formerly on the exterior of the polypus. Hence not only the inner surface of the cavity but also the surface of these interior lobes, as it were, are covered with the same epithelium as the outer surface of the polypus. The epithelium now by proliferating inward strangulates various portions of the tumor in the *interior* of the polypus in a manner similar to that which we repeatedly described as taking place on the *exterior* of the polypus, so that the interior lobes just mentioned are separated from their native soil and entirely deprived of nourishment. But while this process going on at the *exterior* surface of the polypus leaves no traces behind, and the particles of the tumor thus separated are usually washed away unnoticed in the secretions of the meatus, the internal lobes of the polypi, as we may thus style them, undergo necrosis without the entrance of air, and produce in all probability those peculiar microscopic pictures which we have described in case 74, and depicted in fig 6, *a*. The strangulated portion deprived of its nourishment, probably swells, fills the cavity completely, and its elements yield sooner or later to retrogressive metamorphosis, the fatty or waxy products of which in our specimens still permit us to recognize the various transformation stages, such as swelling, formation of fatty granules, and confluence of the granules into little conical bodies. The connective tissue formerly contained in the lobes which have undergone necrosis has probably furnished the tenacious, hyaline substance in which the fatty bodies as well as the remnants of cells are embedded.

IV.—*Formation of cysts*

was only observed in one case, and in that from the blood-vessels (case 18).

TREATMENT OF AURAL POLYPI.

A majority of our observations belong to a time when the surgical and medical treatment of aural polypi was still immature. Many of our remarks scattered at random amongst the notes of the cases are at this date widely open to criticism. We will refer, for instance, to the cauterization with the silver-nitrate pencil, of polypi or of their roots after removal of the body of the polypus with the snare, a procedure which for evident reasons has now been generally abandoned. Beyond this, however, we will venture to speak a few words concerning our experience with other methods of treatment.

The operative removal of aural polypi must be undertaken without hesitation.

1. As a matter of life and death, when the symptoms indicate an accumulation of pus. Various cases (27, 32, 49, 59), moreover, show that the operation may be entirely successful even when cerebral symptoms are undeniably present.

2. In all cases in which a single polypus or several of them together have attained so large a size that they are liable to fill the cavities in which they lie, and to give rise to an accumulation of pus with all its accompanying dangers.

In such cases as these we can never be sure how long or how short a period may ensue before fatal consequences appear. In case 15, *e. g.*: facial paralysis appeared in ten days *after* the operative removal of the polypus. If we had lost a few weeks' time in this case in remedial treatment, it is probable that this complication would not have continued *the only one*, or that it would not have disappeared at all, as it really did, as the history of the case shows.

Polypi that are not quite large enough to hinder a satisfactory exit of pus, may experimentally be treated with remedies: amongst which we place in the front rank absolute alcohol,[1] which was first recommended by Politzer, and subsequently employed with great satisfaction by ourselves and others; or with acetate of lead in the strength and with the modifications which we from time to time have suggested.

Method of using lead acetate.

We use this remedy in both private and dispensary practice, not only in simple chronic suppurative inflammation of the tympanum, but in similar cases complicated with polypi. Experience has, however, taught us that we cannot rely upon it in cases of caries. Since 1869, Moos has employed it most successfully in hundreds of various cases of the above-mentioned diseases; a perfect cure with cicatrization of the perforated *Mt* being almost invariably gained. It is true enough that many practitioners before our time had used solutions of lead acetate, but we were probably the first to resort to the supersaturated solution in water. For we use from ten to twenty-five per cent. of lead, with the addition of five to ten drops of acetic acid. We thus have a transparent solution (which should never be turbid). The patient's head being held toward the shoulder, the solution is dropped into the ear from a glass pipette, and the ear is then plugged with salicylic cotton (which should not be pushed too deeply into the ear) in order to keep the remedy as long as possible in contact with the affected surface. This should be done at least twice a day, after thoroughly cleansing the ear. The application of the remedy is occasionally followed by a more or less stinging or burning pain, which is, however, generally transitory and does not hinder us from prosecuting the treatment. Pain is also sometimes felt in the pharynx when the solution flows off along the Eustachian tube.

[1] The favorable resorbent action exercised upon aural polypi by other remedies also seems to depend upon the action of the alcohol which they contain. Thus, to cite a pertinent case, Moos, as far back as 1859, effected a radical cure in the case of a tympanic polypus extending quite to the meatus, as well as simultaneous cicatrization of the perforation in the *Mt*, by simply brushing the tumor with laudanum for a period of about six weeks.

We are sometimes so fortunate as to find in the course of a very few days that the mucous membrane of the promontory, previously red and thickened, has already become less swollen and grown paler, that the discharge has decreased in amount, and that the inflammation has even disappeared with or without closure of the perforation. The duration of treatment depends greatly upon the individuality of the case, particularly upon the intensity and extent of the local morbid process, and upon any constitutional symptoms that may be present. In our series of cases may be seen some of double suppurative inflammation of the tympanum following scarlatina, which were absolutely cured after a treatment of six weeks.

We will not further dilate upon this method, but refer its value to a test at the hands of our professional brethren, leaving it still an open question whether the acetic acid and the plugging of the meatus may not simultaneously exert a certain amount of antiseptic action.

If the solution is used too freely, as may happen if we leave the treatment to the patients themselves, painful excoriations may appear in the meatus. But if these excoriations should be noticed, we must abandon the lead solution till they cicatrize. Ten or fifteen drops are not too many, particularly in case of a large defect in the *Mt.* We have never known the solution to cause anchylosis of the ossicles and defect of hearing from deposits of lead, as suspected by Politzer. On the whole, there are but two precipitates possible during the use of the acetate of lead: *a*, hydric oxide of lead, which is white and soluble; *b*, anhydrous oxide of lead, which is red, and has never yet been observed; *c*, sulphate of lead, which is black, and can easily be syringed away. White or whitish-yellow albuminates of lead may also occasionally be observed.

Manner in which the modified solution of lead acetate acts upon aural polypi.

In case No. 36, granulation tumor of the tympanum, with horny layer 9 × 6 *mm.*, and case No. 88, two granulation polypi of the wall of the labyrinth, both 6 × 5 *mm.*, we had

a good opportunity of carefully studying the physiological action of this remedy, but we are obliged to confess that we have seen only one case in which it really seemed to destroy and throw off the polypus from its native soil. In brief, its action is this: it probably opacifies and shrivels the cell-eleme ts of the tumor, constringes the blood-vessels, and causes thrombosis (which we have observed microscopically [1]), which in turn is followed by further shrivelling or necrosis, or even total exfoliation, without any hemorrhage, as in case 36. The superfluous lead can then be recognized as a finely granular black deposit (sulphate of lead) in the stroma of the polypus. It is probable that the favorable effect of this solution in chronic suppurative inflammation of the tympanum acts in the above-mentioned manner.

Our experience with the favorable action of the modified lead solution has been more extended than with that of alcohol, for we had used the former for years before the alcohol treatment was recommended. And yet in one case, No. 67, alcohol was the only remedy that was successful. Still, in other cases in which alcohol had failed to act beneficially, even after weeks of use, we obtained a cure by resorting to the modified lead solution.

If we may venture to explain our lack of success in the treatment of aural polypi with alcohol as compared with the lead solution, we would simply say that alcohol is probably more suitable for cases of granulation polypi, lead for the coarser fibromatous neoplasms. Still we must wait for further comparative experience upon this point. It is also possible that, in cases of tympanic polypi with minute perforations in the *Mt*, alcohol may act more favorably on account of its greater power of penetration (compare on this point, cases 67 and 68).

Galvano-cautery.

Although many of our most skilful aurists do not use the galvano-cautery, we must express the opinion, based upon five years of experience, that there are cases in which

[1] Perhaps the lead solution reaches the interior of the blood-vessels and causes direct thrombosis by coagulation.

we can only gain a rapid cure or even any cure at all, by means of the galvano-cautery. It has been serviceable to us:

1. As the very best method of after-treatment to prevent relapses.

2. In the rapid removal of smaller tumors that could not be reached at all, or only with difficulty, with the snare; *e. g.*, when the granulations are attached to the hammer or other bony parts in cases of perforation of the *Mt.*

3. In cauterizing cholesteatomatous masses in the tympanum, usually so difficult to remove. The common way is to resort to instillations to soften these masses and then to syringe them away. But instead of softening, they frequently begin to swell, cause pain and even inflammation. A single application of the galvano-cautery will often suffice to destroy them (compare case 65).

4. In producing a stiff cicatricial tissue as free from blood-vessels as possible, in the place of a softened and thickened lining of the tympanic cavity that has undergone epidermoidal transformation and is liable to continue in a chronic inflammatory condition. In this point of view compare the frequent relapses in case 17, which were treated without the galvano-cautery.

5. In cases of multiple formation of larger or smaller polypi whose origin in the deeper-seated portions of the ear is difficult to detect, and in which it is quite impossible to remove all the roots with the snare (case 92).

6. In caries with formation of polypi, whenever it is necessary to obtain a satisfactory exit for the pus.

A CASE OF BILATERAL DEAFNESS FROM MUMPS.

By H. KNAPP.

TOTAL deafness from mumps in one or both ears is spoken of in general terms by many authors, but it seems that only of late detailed histories of such cases have been reported. The clinical material for a comprehensive description of the affection and for a discussion of its nosology is still so scant as to encourage the publication of new observations. To the five cases which Brunner cites in his paper upon this subject on pages 102–105 of this volume, another one, published on page 232 of this volume, in my report on 806 cases of ear disease may be added, in which the deafness, without any evidence of middle-ear affection, was on the right side only. In the following case the deafness was on both sides, absolute, and likewise without affection of the middle ears.

Theresa O., æt. twenty five years, of New York City, consulted me Aug. 10, 1882, giving the following history. She had never had any ear disease, and had enjoyed perfect hearing and good health until six years previously, when in the autumn she suffered from an acute attack of mumps, with immense swelling on both sides, which lasted two weeks. On the sixth day her hearing was still good, on the seventh it was weak, on the eighth completely lost, and has remained so ever since. She complained of earache and headache, but had no discharge. On the seventh and the following days she suffered from great dizziness, which lasted for months, and, in fact, has never completely disappeared, for frequently now she feels dizzy and inclined to fall over. She does

not remember the presence of tinnitus aurium ; certainly she had none during the last year.

I found the patient a healthy, intelligent, and well-developed young lady, who, during the six years of total deafness, had lost nothing of her speech. She could not hear a sound either by air- or bone-conduction. Words spoken in her ears through a hearing tube or otherwise produced an unpleasant sensation, but not that of sound. A large tuning-fork placed on the tragus, and with it stopping the ear-canal, was felt, not heard ; the same when placed on different parts of the skull. Physical examination of the ears, Eustachian tubes, and the naso-pharynx revealed perfectly normal conditions. Inflation, even by Valsalva's experiment, was easy.

To my mind the total deafness, its rapid, almost sudden occurrence, the absence of marked symptoms of middle-ear disease, the dizziness and disturbances of equilibrium long after the attack has ceased, are sufficient evidence that the lesion in these cases is labyrinthine, not tympanic. Whether its nature is a serous, hemorrhagic, or purulent inflammation can, in the absence of autopsies, not be decided. A direct continuation of the disease through the auditory canal and the tympanic cavity, or through the canal of the facial nerve, is a vague and quite improbable supposition. I have seen cases of acute epidemic parotitis—one in which the father and two of his children were affected—complicated with middle-ear disease, but the symptoms were totally different from those in the above-cited instances. First the walls of the ear canal became red and greatly swollen, so that for a time scarcely any calibre was left, then the membrana tympani was red and thickened, soon it perforated, and a free purulent discharge set in, which lasted longer than the parotitis, but finally all the aural symptoms disappeared, and the perforation in the *Mt* closed. The impairment of hearing increased gradually, and reached only a moderate degree corresponding to the intensity of the otitis media. After the recovery the hearing was perfect. Bone-conduction never was weakened, and dizziness and disturbances of equilibrium not complained of either during or after the attack of mumps. I think the total sudden deafness in mumps without middle-ear affection is of a metastatic

nature, like the orchitis and other complaints which are noticed during the same disease. It does not follow that all metastatic affections of the inner ear must result in total deafness. In the eye, though metastatic irido-choroiditis is doubtless a very disastrous disease, some affections of an evidently metastatic nature run their course without destroying the organ or even seriously damaging the vision. I related such a case at the meeting of the American Ophthalmological Society in July, 1882; and what experienced oculist, when he is called to treat a case of iritis complicated with an inflammation of the knee joint, does not know at once that both affections were shortly preceded by gonorrhœa of the urethra? The affection of those disconnected organs is evidently not the result of propagation of the *materies morbi* along an uninterrupted tissue-channel, but through the current of blood, if we leave the reflex irritation out of the question. The continued investigations on micro-organisms are likely at no very distant day to throw light on this as on many other subjects. Until that day the convenient word "gonorrhœa metastases" will not be out of order. But every oculist knows also that the gonarthritis and the iritis resulting from gonorrhœa of the urethra, get well and usually do not destroy sight. In a similar way, it is quite likely that the milder forms of metastatic affection of the inner ear in mumps disappear without destroying hearing, or without destroying it in both ears, just as in the above-mentioned case of metastatic irido-choroiditis (from metritis), the affection in one eye was mild and terminated in recovery of sight, while in the other it destroyed the eye. The cases of loss of hearing during mumps are rare, yet the affection may be more frequent than we thus far know, as it is not impossible that we have failed to diagnosticate many a mild case.

MISCELLANEOUS NOTES.

The unabridged translation of Politzer's "Text-Book on the Diseases of the Ear and Adjacent Organs," by Dr. James Patterson Cassels, of Glasgow, in one stately volume of 800 pages (London: Baillière, Tindal, & Cox; Philadelphia: H. C. Lea's Son & Co.), is before us. The admirable treatise will be reviewed, by a German pen, in our next issue, but we cannot delay expressing our obligations to the distinguished translator for bringing out this standard work in clear and good English almost simultaneously with the original.

INDEX OF AUTHORS TO VOLUME XI.

BRANDEIS, R. C. Two Cases of Tinnitis Aurium Caused by Disturbances in the Current of Cervical Blood-vessels . . . 155

——— Otitis Media Catarrhalis: Objective Sounds (Spasmodic Contraction of Tubal Muscles?); Nervous Origin; Hysteria . . 161

BRESGEN, MAX. Der Chronische Nasen- und Rachencatarrh. Eine klinische Studie. Reviewed by A. Hartmann, of Berlin 61

BRUNNER, G. A Case of Complete Unilateral Deafness after Mumps, with Critical Remarks 102

BURCKHARDT-MERIAN, ALBERT. Supplement to Prof. Moos and Dr. Steinbrügge's Case of Hyperostosis and Exostosis: Ankylosis of the Head of the Hammer, Bony Closure of the Round Window, etc. . . . 106

BURNETT, SWAN M. Abstract of American Otological Literature from November, 1881, to July, 1882 286

GRAF, F. On Artificial Drum-Membranes, and Especially the Cotton Pellet 109

HARTMANN, ARTHUR. Die Krankheiten des Ohres und deren Behandlung. Reviewed by G. Brunner 63

HARTMANN, STEINBRÜGGE, WOLF. Report on the Progress of Otology in the Second Half of the Year 1881 (July to November) 68

I.—Normal and Pathological Anatomy of the Organ of Hearing. H. Steinbrügge.

II.—Physiology of the Organ of Hearing and Physiological Acoustics. Oscar Wolf.

III.—Pathology and Treatment of the Organ of Hearing. A. Hartmann.

——— Report on the Progress of Otology During the Second Half of the Year 1881 . . . 164

I.—Comparative Anatomy. H. Steinbrügge.

II.—Pathology and Therapeutics. A. Hartmann.

——— Report on the Progress of Otology for the First Half of the Year 1882 243

I.—Normal and Pathological Anatomy and Histology of the Ear. H. Steinbrügge

II.—Physiology of the Organ of Hearing, and Physiological Acoustics. Oscar Wolf.

III.—Pathology and Therapeutics of the Ear. A. Hartmann.

KNAPP, H. Congenital Fibrous Closure of the Auditory Meatus. Opening Frustrated by Hæmatophilia 19

——— A Case of Transient Poisoning from the Instillation of a Few Drops of Atropia into a Healthy Ear Canal 23

——— Report on 806 Cases of Ear-Disease Treated in Private Practice During the Years 1880 and 1881 199

——— A Case of Bilateral Deafness from Mumps 385

MOORE, OLIVER W. Acute Otitis Media Supervening on Otitis Media Purulenta Chronica, Resulting in Necrosis of Temporal, Occipital, and Parietal Bones, with Closure of Lateral Sinus and Abscess of Cerebellum . 25

MOOS, S. A Case of Double Labyrinthine Affection, with Staggering Gait and Permanent Abolition of Hearing after Mumps 13

——— Double Hearing During the Exhibition of Iodide of Potassium 27

——— Railroad Accidents in Connection with Bad Hearing of Engine-Drivers 91

——— Etiology and Results of Examination of Forty Cases of Congenital Deafness . . . 299

MOOS, S. and STEINBRÜGGE, H. On the Combined Occurrence of Rachitic Alterations and Disturbances of Development in the Ears of a Crétin . . . 1

——— Hyperostosis and Exostosis: Anchylosis of the Head of the Hammer, Bony Occlusion of the Round Window, and Colloid Degeneration of the Auditory Nerve in the Petrous Bone of an Aged Lunatic Affected with Hallucinations . 9

——— On the Formation of a Neo-Membrane in the Drum-Cavity, Resulting from Hemorrhagic Pachymeningitis . . 97

——— Total Absence of Both Labyrinths of a Deaf-Mute; with Embryological and Physiological Remarks . . . 236

——— Hemorrhagic Pachymeningitis; Pyæmia; Acute Degeneration of Both Acoustic Nerves; Thrombosis of Right Internal Auditory Artery . . 322

——— Histological and Clinical Report of One Hundred Cases of Aural Polypi. (With 14 drawings on tables i, ii, and iii.) . 328

MUNSON, G. S. A Case of Chronic Suppurative Otitis, with Exostosis of the Auditory Canal; Abscess of the Brain; Death; Autopsy 29

PIERCE, F. M. Case of Extensive Disease of the Temporal Bone, with Hernia Cerebri 313

SCHALLE, R. On Aural and Naso-Pharyngeal Diseases, and Some of their Methods of Treatment 113

STEINBRÜGGE, H. A Case of Diplacusis 15

STEINBRÜGGE and MOOS. *See* MOOS and STEINBRÜGGE.

TRÖLTSCH, A. v. Lehrbuch der Ohrenheilkunde mit Einschluss der Anatomie des Ohres. Reviewed by A. Hartmann . . 57

TURNBULL, LAURENCE. Imperfect Hearing and the Hygiene of the Ear, Including Nervous Symptoms, etc. Reviewed by A. Hartmann 60

WEIL, E. Results of an Examination of the Ears and the Hearing of 5,905 School-Children . 33

WINSLOW, W. H. The Human Ear and its Diseases: a Practical Treatise upon the Examination, Recognition, and Treatment of Affections of the Ear and Associate Parts, etc. . . 66

INDEX OF SUBJECTS TO VOLUME XI.

Absence of Both Labyrinths of a Deaf-Mute; with Embryological and Physiological Remarks. By S. Moos and H. Steinbrügge 236

Abstract of American Otological Literature, from November, 1881, to July, 1882. By Swan M. Burnett 286

Artificial Drum-Membranes, and Especially the Cotton Pellet. By F. Graf 109

Auditory Meatus, Congenital Fibrous Closure of the. Opening Frustrated by Hæmatophilia. By H. Knapp . . . 19

Aural and Naso-Pharyngeal Diseases, and Some of their Methods of Treatment. A Posthumous Paper by R. Schalle . . 113

Aural Polypi, Histological and Clinical Report of One Hundred Cases of. By S. Moos and H. Steinbrügge 328

Congenital Deafness, Etiology and Results of Examination of Forty Cases of. By S. Moos . 299

Diplacusis, A Case of. By H. Steinbrügge 15

Double Hearing During the Exhibition of Iodide of Potassium. By S. Moos 27

Ear, The Human, and its Diseases. By W. H. Winslow. Reviewed by S. M. Burnett . 66

Exostosis of the Auditory Canal, A Case of Chronic Suppurative Otitis, with; Abscess of the Brain; Death; Autopsy. By Dr. G. S. Munson 29

Hearing of 5,905 School-Children, Results of an Examination of the Ears and the. By E. Weil 33

Hearing, Imperfect, and the Hygiene of the Ear, Including Nervous Symptoms, etc. By Laurence Turnbull, M.D. Reviewed by A. Hartmann . 60

Hemorrhagic Pachymeningitis, On the Formation of a Neo-Membrane in the Drum-Cavity, Resulting from. By S. Moos and H. Steinbrügge . . . 97

Hemorrhagic Pachymeningitis; Pyæmia; Acute Degeneration of Both Acoustic Nerves; Thrombosis of Right Internal Auditory Artery. By S. Moos and H. Steinbrügge . . . 322

Hyperostosis and Exostosis: Anchylosis of the Head of the Hammer, Bony Occlusion of the Round Window, and Colloid Degeneration of the Auditory Nerve in the Petrous Bone of an Aged Lunatic Affected with Hallucinations By S. Moos and H. Steinbrügge . . 9

Krankheiten des Ohres, Die, und deren Behandlung. By Dr. Arthur Hartmann. Reviewed by G. Brunner 63

Lehrbuch der Ohrenheilkunde mit Einschluss der Anatomie des Ohres. By Dr. A. v. Tröltsch. Reviewed by A. Hartmann . 57

Miscellaneous Notes . 198, 297, 388

Mumps, A Case of Double Labyrinthine Affection, with Staggering Gait and Permanent Abolition of Hearing after. By S. Moos 13

——— A Case of Complete Unilateral Deafness After, with Critical Remarks. By G. Brunner 102

——— A Case of Bilateral Deafness from. By H. Knapp . . 385

Nasen- und Rachencatarrh, Der Chronische. Von Dr. Max Bresgen. Reviewed by A. Hartmann 61

Necrosis of Temporal, Occipital, and Parietal Bones, with Closure of Lateral Sinus and Abscess of Cerebellum. By W. Oliver Moore 25

Obituary.—Dr. R. Schalle . . 90

Objective Sounds (Spasmodic Contraction of Tubal Muscles?); Nervous Origin; Hysteria. By Richard C. Brandeis. 161

Personal Intelligence 90

Poisoning, A Case of Transient, from the Instillation of a Few

Drops of Atropia into a Healthy Ear Canal. By H. Knapp 23

Rachitic Alterations, On the Combined Occurrence of, and Disturbances of Development in the Ears of a Crétin. By S. Moos and H. Steinbrügge . . 1

Railroad Accidents in Connection with Bad Hearing of Engine-Drivers. By S. Moos, M.D. . 91

Report on the Progress of Otology in the Second Half of the Year 1881 (July to November). 68

I.—Normal and Pathological Anatomy of the Organ of Hearing. By H. Steinbrügge.
II.—Physiology of the Organ of Hearing and Physiological Acoustics. By Oscar Wolf.
III.—Pathology and Treatment of the Organ of Hearing. By A. Hartmann.

Report on the Progress of Otology during the Second Half of the Year 1881 164

I.—Comparative Anatomy. By H Steinbrügge
II.—Pathology and Therapeutics. By A. Hartmann.

Report on the Progress of Otology for the First Half of the Year 1882 243

I.—Normal and Pathological Anatomy and Histology of the Ear. By H. Steinbrügge.
II.—Physiology of the Organ of Hearing and Physiological Acoustics. By Oscar Wolf.
III.—Pathology and Therapeutics of the Ear. By A. Hartmann.

Report on 806 Cases of Ear Disease Treated in Private Practice during the Years 1880 and 1881. By H. Knapp . 199

Supplement to Prof. Moos and Dr. Steinbrügge's Case of Hyperostosis and Exostosis, etc. By Albert Burckhardt-Merian . 106

Temporal Bone, Case of Extensive Disease of the, with Hernia Cerebri. By F. M. Pierce, M.D. 313

Tinnitus Aurium, Two Cases of, Caused by Disturbances in the Current of Cervical Blood-vessels. By R. C. Brandeis . . 155

Fig. 1. (3/2)

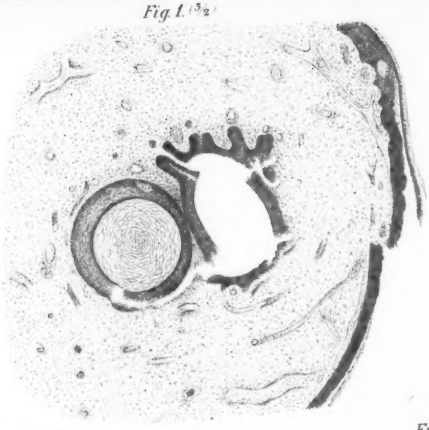


Fig. 2. (2/2)

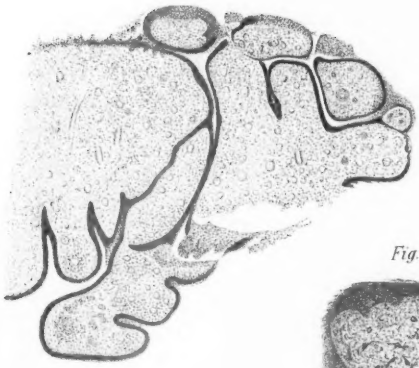


Fig. 1 a. (2/1)

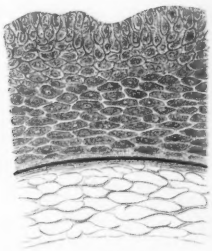


Fig. 3. (2/2)

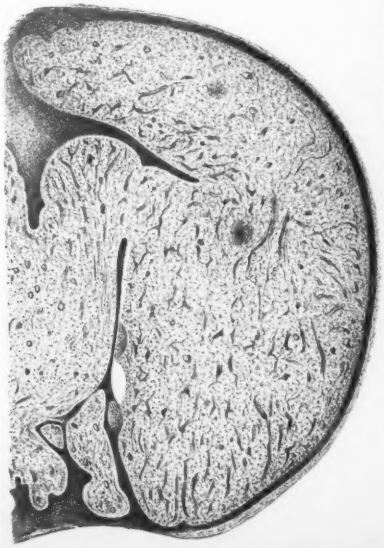


Fig. 1 b (2/1)

Wittmann lith.

Lith. Anst. Werner & Winter, Frankfurt a/M.

Fig. 4. (3/2)

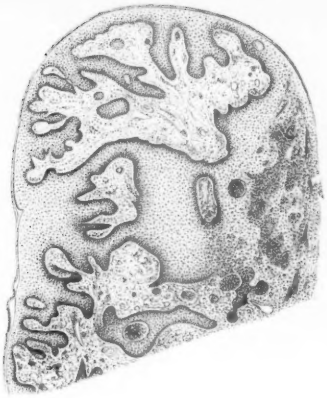


Fig. 5. (3/2)

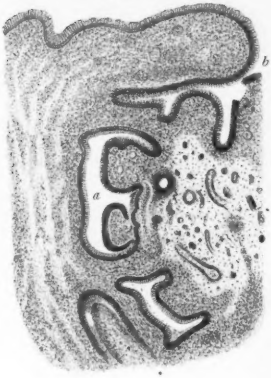


Fig. 6. (2/2)

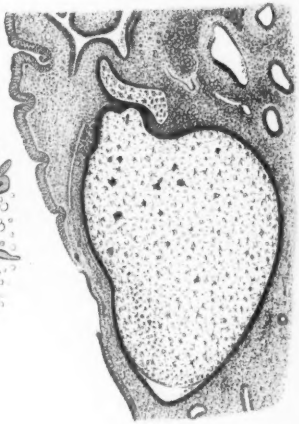


Fig. 6.a. (3/2)

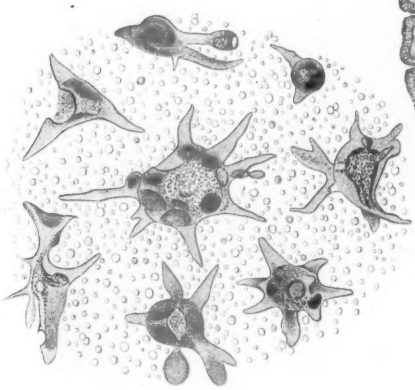
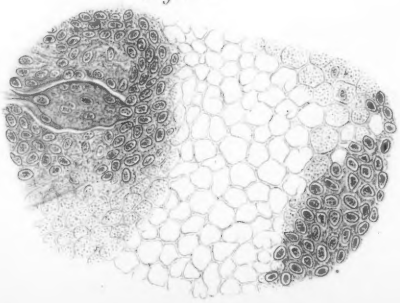


Fig. 7. (3/2)



Lith. Anst. v. Werner & Winter, Frankfurt a/M.

Fig. 8. $^{2}/_{7}$

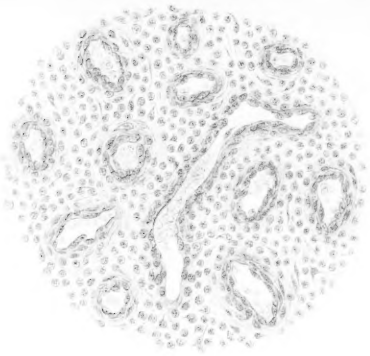


Fig. 9. $^{2}/_{7}$

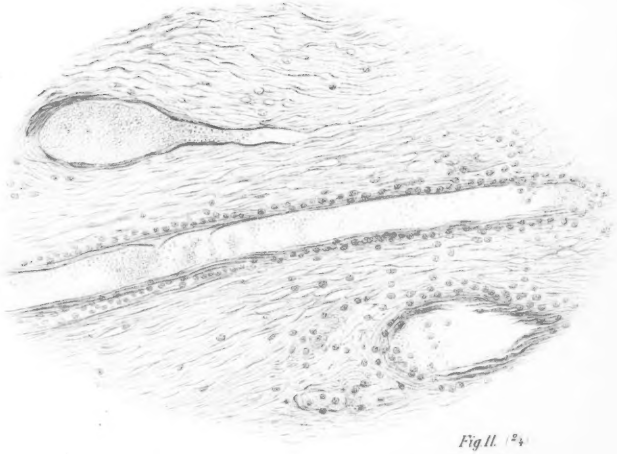


Fig. 10. $^{3}/_{4}$

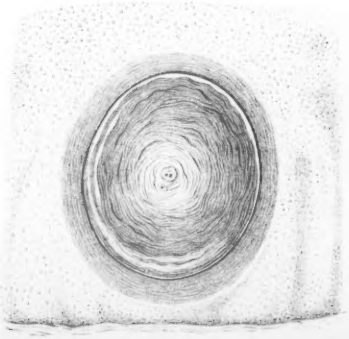


Fig. 11. $^{2}/_{4}$